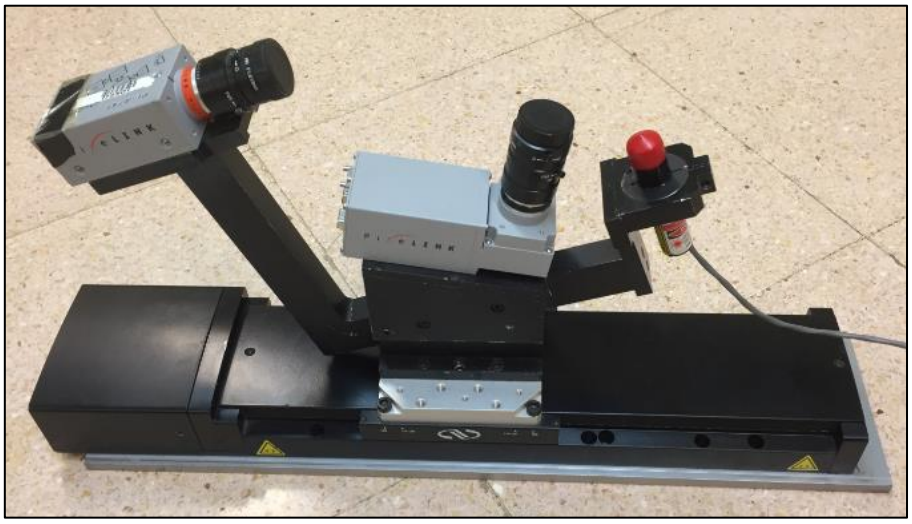
Anexo I: Equipamiento

1. Equipamiento del sistema de medición

El equipamiento consiste de una cámara CCD con su óptica, filtro y sistema de iluminación laser. Además incluye una estación lineal de traslación (ELT) de alta precisión y su control. Sobre el carro de la ELT se sitúan los diferentes componentes. En la Figura 2, se muestra una imagen del equipamiento.



- **Cámara**: Modelo PL-A471, de la marca PixeLinck.
- **Lente cámara**: Modelo 31214 MCN, de la marca Goyo Optical Inc.
- **Láser y lente**: Modelo Sting Ray DS-1014, de la marca COHERENT.
- **Estación lineal de traslación (ELT):** Modelo ILS250PP, de la marca Newport.
- **Controladora de la ELT**: Modelo ESP301, de la marca Newport.

A continuación se muestran los hojas de características definidas por el fabricante de cada uno de los componentes del equipamiento.

1.1. Cámara

PixeLINK PL-A741 MV Camera

The all-in-one digital camera designed with your machine vision application in mind.

General Description

The PL-A741 is a high-performance, 1.3 megapixel monochrome C-mount camera designed specifically for machine vision applications. Fully IIDC 1.3 (DCAM) compliant, the PL-A741 uses a standard FireWire interface for plug-and-play operation with the host computer. Extended features—such as trigger and general-purpose output controls—add a level of functionality beyond the IIDC standard, providing excellent performance for the price.

- Easy to Use
- Cost-Effective
- IIDC 1.3 (DCAM) Compatible with Extended Features
- FireWire Interface
- 33 fps Uncompressed at 1k × 1k
- Extended Dynamic Range
- Global Shutter—Frame on Demand
- External Trigger (TTL to 12 V range)
- Available in "Right Angle" Configuration
- Fully Supported by Software, for Operation "Out of the Box"

Easy to Use!

- **Compatible:** The PL-A741 can be operated right out of the box with any system that supports the FireWire (IEEE 1394) IIDC 1.3 specification. Within minutes, the camera can be controlled by any IIDC compatible software such as Linux, National Instruments LabVIEW, and a host of other applications.
- **Connectable:** The PL-A741 connects to the computer via a single FireWire cable that supplies power to the camera and allows high-speed data communication. No special or expensive frame grabber card is required. The camera's two FireWire ports allow multiple cameras to be connected together ("daisy chained") on a single FireWire bus. The external trigger allows cameras to be synchronized with each other or with external systems.
- **Controllable:** The camera's rich set of features and capabilities can all be controlled through software. A global shutter and external trigger allow synchronization in demanding machine vision applications.
- **Fast:** In video mode, the camera's rolling shutter[1] can deliver 33 fps at 1k x 1k resolution, 107 fps at VGA resolution (640 × 480), and 8000 fps at 64 × 64, all with a user-definable region of interest (ROI). Full-field-of-view images can be decimated for high-speed transmission.
- **Extendable:** With the Developer's Kit, PixeLINK supplies an extensive Application Programming Interface (API) and camera control GUI for fast and easy application development.

Advanced Features Include:

- On-board non-volatile memory for storage of the camera settings. When the camera is shut down, it can be restarted with the same settings even when connected to a different computer.
- Multiple-slope dynamic range controls for balanced image exposure. Reduce overexposure of bright areas while increasing the level of visible detail in dark areas, without losing data in the image, by defining up to the three "knee points" in the exposure time.
- Two general-purpose output connections for camera-based control of external equipment such as lighting and filters. The output controls can be software enabled or programmed to respond to an input trigger signal incorporating user-defined delays.
- Enhanced trigger with delay timings relative to output controls and start of image capture.
- Decimation (ROI sub-sampling) to increase field of view at lower resolutions.
- On-camera, user programmable lookup table (LUT).
- In-field reprogrammability of the camera firmware. Extend the camera's lifetime by applying updates via FireWire.

PixeLINK provides extensive software support. Go to the PixeLINK web site (*www.pixelink.com*) to download an extensive sample application for configuring the PL-A741 and for viewing and capturing images. The application demonstrates the full capabilities of the camera, including its IIDC features.

PixeLINK also offers a Software Developer's Kit (SDK) to help you in your evaluation of the PL-A741. The SDK includes an Application Programming Interface (API) designed to simplify integration and shorten the development cycle of your software. The API, which is compatible with C++ and Visual Basic, allows access to the extended features of this camera, increasing functionality beyond the IIDC specification.

The PL-A741 is also sold bundled with the SDK as a Developer's Kit.

[1] The rolling shutter option will be implemented in a near-future release of the PL-A741. The current release uses a synchronous (global) shutter. Contact PixeLINK (sales@pixelink.com) for more information and availability.

PixeLINK
MAKING DIGITAL IMAGING SIMPLE

Información más detallada y catálogo del producto, acceder a la página web http://pixelink.com/home/products/.

1.2. Lente de cámara

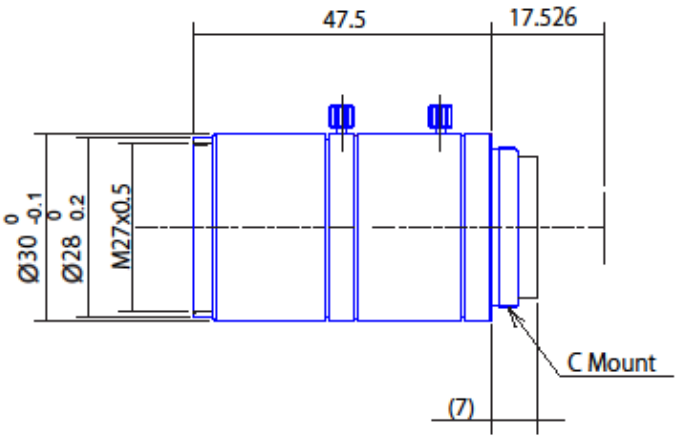
1106

GOYO OPTICAL INC.

Industrial Lens

High Resolution Megapixel Lenses

Item No.GMTHR31214MCN



ITEM NO.		GMTHR31214MCN
Focal Length		12.3 (mm)
Iris Range		F1.45 - 16
Angle of View (Hx V x D)	2/3"	39.59° x 30.17° x 48.38°
MOD		0.1 (m)
Filter Thread		M27.0 , P=0.5
Dimention (D x L)		Ø30 x 47.5 (mm)
Weight		90 (g)
Notes		3megapixel

GOYO OPTICAL Inc., 3-8-31 HAMASAKI, ASAKA, SAITAMA 351-0033, JAPAN,
TEL:+81-48-474-2235 FAX:+81-48-474-7373
http://www.goyooptical.com E-MAIL:info@goyooptical.com

Información más detallada y catálogo del producto, acceder a la página web http://www.goyooptical.com/.

1.3. Láser y lente

COHERENT.

Coherent StingRay

Structured Light Pattern Generating Laser

In today's world of expanding 3D vision systems, the camera and laser are equal partners in the accuracy, stability and repeatability of the measurements made and used by these applications. The requirements on the laser for uniformity, power, pointing and electrical stability are far above a typical illumination system requirements. Having a source which produces very high power density, very thin measurement cross sections with a uniform return that does not mask the profile of the object is critical to the continued success of these demanding applications. The technology and advancement of these lasers has stayed the same for many years now, not giving the user the ability to leverage this portion of the system beyond its current technology.

The Coherent StingRay laser platform is a re-vision of this technology, taking technology and best practices from leading edge applications in Bioinstrumentation and Laser Measurement and Control. The Coherent StingRay laser incorporates state of the art electronics, optics and mechanics to provide a compact, highly flexible and reliable laser source that re-sets the standard in Machine Vision.

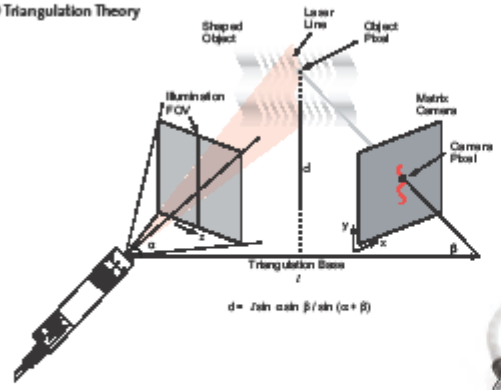
Coherent StingRay Features:

- 450 nm to 830 nm
- Power up to 200 mW
- Uniformity up to 95%
- External focusability
- Pointing <10 µrad/°C
- Microprocessor controlled
- Advanced service monitor
- RS-232 controllable with GUI interface
- Auto scaling input power 5 to 24 VDC

Coherent StingRay Applications:

- Non-contact Height Measurements
- Automotive Production
- Extrusion Measurements
- Medical/Dental
- Transportation
- Wood Processing
- Steel Production
- Microelectronics Inspection
- Food Portioning/Inspection
- Glass Inspection

3D Triangulation Theory



www.Coherent.com/CoherentStingRay

Superior Reliability & Performance

Información más detallada y catálogo del producto, acceder a la página web http://www.coherent.com/.

1.4. Estación lineal de traslación (ELT)

For Motion, Think Newport™

ILS Series

HIGH-PERFORMANCE MID-RANGE TRAVEL LINEAR STAGES

- High stiffness, FEM optimized extruded aluminum body avoids thermal bending effects
- Precision recirculating ball bearing slides provide accurate linear motion without ball cage migration
- Ball screw drive version allows rapid movement with short step and settling time
- LM version with 3-Phase synchronous ironless linear motor with linear steel scale

The ILS Series linear stages are available from 50 to 300 mm travel and offer high performance at low cost. Fast, sub-micron minimum incremental motion is provided in a highly stiff and robust package. Features include: recirculating ball bearing slides to provide excellent payload capabilities and long life; FEM-optimized extruded aluminum body to avoid bending effects or deflection under load. The ILS series are available in ball screw and linear motor drive versions. The preloaded, backlash-free ballscrew version provides rapid motion with fast step and settling times. For PP, CC and CCL models, position measurements are read with a 4000 pts/rev. encoder mounted directly on the screw. The HA model features an integral linear scale providing 0.1 µm resolution feedback. The linear motor version ILS-LM series employs a centered, high efficiency 3-phase synchronous ironless, linear motor as driving element, providing high speed, high acceleration and high system responsiveness. The ILS series stages are ideal for many precision industrial applications such as semiconductor wafer inspection, micro-electronics test and assembly, pick and place, DNA sequencing and laser machining.

YouTube — scan QR code to watch video

Specifications

	ILS		ILS-LM
Version	**PP, CC, CCL[1]**	**HA**	
Travel Range (mm)	50, 100, 150, 200, 250		100, 200, 300
Minimum Incremental Motion (µm)	1.0	0.3	0.01
Uni-directional Repeatability (µm)	PP: 1.5; CC,CCL: 1.0	0.4	0.4
Bi-directional Repeatability[2] (µm)	2.5 or ±1.25	0.7 or ±0.35	0.6 or ±0.3
On-Axis Accuracy[2] (µm)	ILS50: 3 or ±1.5; ILS100: 4 or ±2 ILS150: 5 or ±2.5; ILS200: 7.5 or ±3.75 ILS250: 10 or ±5	ILS50: 4 or ±2; ILS100: 3 or ±1.5 ILS150: 4 or ±2; ILS200: 6 or ±3 ILS250: 7.5 or ±3.75	ILS100: 3 or ±1.5 ILS200: 4 or ±2 ILS300: 5 or ±2.5
Maximum Speed (mm/s)	PP: 50; CCL & CC: 100	100	500[4]
Pitch[2][3] (µrad)	ILS50: 50 or ±25; ILS100: 100 or ±50 ILS150: 150 or ±75; ILS200: 200 or ±100 ILS250: 250 or ±125		300 or ±150
Yaw[2][3] (µrad)	ILS50: 50 or ±25; ILS100: 75 or ±37.5 ILS150: 100 or ±50; ILS200: 130 or ±65 ILS250: 150 or ±75		ILS100: 75 or ±37.5 ILS200: 130 or ±65 ILS300: 200 or ±100
MTBF (h)	20,000		
Weight (kg)	ILS50CC: 4.2, ILS100CC: 4.5, ILS150CC: 4.8, ILS200CC: 5.1, ILS250CC: 5.4		

1) *ILSCCL used with the SMC100CC controller only.*
2) *Shown are peak to peak, guaranteed specifications or ±half the value. For the definition of typical specifications which are about 2X better than the guaranteed values, visit newport.com in the Motion Control Metrology Primer.*
3) *To obtain arcsec units, divide mrad value by 4.8.*
4) *With a 44 V driver (such as the XPS-DRV02 board of the XPS controller).*

Newport. Experience | Solutions

Información más detallada y catálogo del producto, acceder a la página web https://www.newport.com/.

1.5. Controladora

Información más detallada y catálogo del producto, acceder a la página web https://www.newport.com/.

Anexo II: Diseño Prototipo

1.1. Concepto y opciones de diseño

El concepto para desarrollar el diseño de este proyecto es la regulación de una mesa de calibración en las tres direcciones espaciales, es decir, los tres ejes de rotación y las direcciones espaciales primarias. La siguiente ilustración muestra el concepto general sobre el cual se va a desarrollar el diseño.

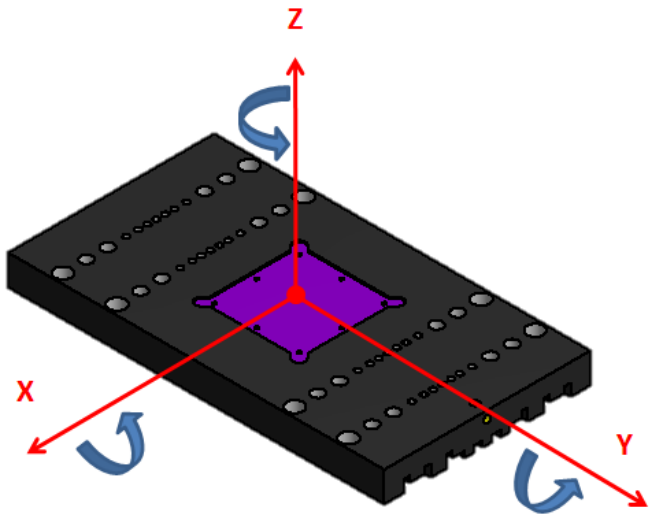


Figura 1: Concepto de regulación.

Las diferentes opciones de diseño se basan en la integración del sistema mecánico de regulación y búsqueda de puntos de apoyo que permitan una libertad de movimiento.

Diferentes opciones de diseño han sido valoradas para alcanzar el diseño final. Estas opciones han sido modificadas debido a limitaciones en el diseño, integración de componentes o versatilidad del diseño, o la búsqueda de un diseño sencillo y de fácil montaje.

1.2. Concepto Inicial

La necesidad de un sistema mecánico de regulación, se debe a la búsqueda de un prototipo para realizar diferentes mediciones de calibración sin necesidad de un sistema autónomo. La siguiente imagen muestra el sistema actual.

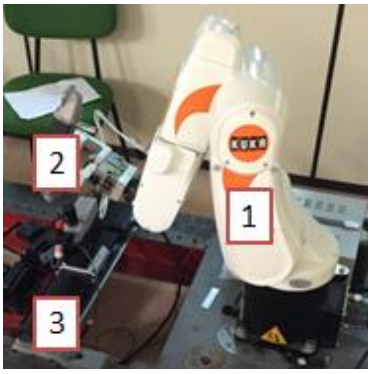


Figura 2: Concepto actual.

En el sistema actual se puede diferenciar:

- Brazo robótico [1]: Encargado del posicionamiento de la mesa de calibración, modelo KUKA KR5SIXXR650.

Figura 3: Brazo KUKA.

- Mesa de calibración [2]: Patrón de dimensiones.

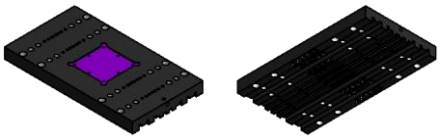


Figura 4: Mesa de Calibración.

- Conjunto de medición [3]: Formado por cámaras, laser y sistema de desplazamiento lineal.

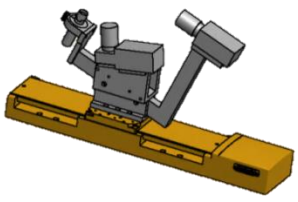


Figura 5: Conjunto de medición.

El punto inicial para el desarrollo del proyecto se puede definir como la creación de un sistema de regulación mecánica que permita reproducir la regulación actual desarrollada por un brazo robótico. El sistema debe de contener una mesa de calibración, cuyas dimensiones son 250x137x20mm.

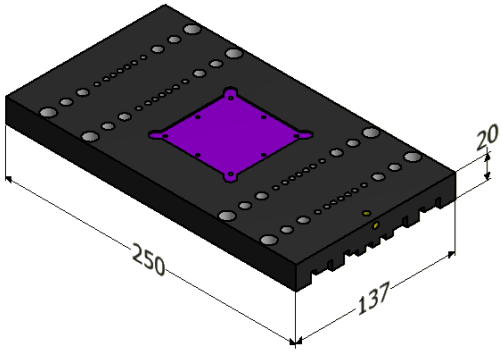


Figura 6: Dimensiones mesa de calibración.

Esta mesa de calibración se caracterizar por tener, en su parte inferior, un área de medición de unas dimensiones (aproximadas) de 200x137. Esta área es uno de los factores más limitantes para el desarrollo del ensamblaje, ya que debe de quedar libre para su correcta funcionalidad.

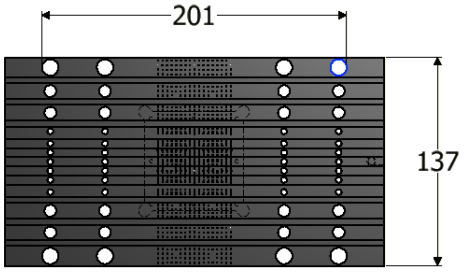


Figura 7: Dimensión de área de medición.

En este sistema, a parte de la integración de la mesa de calibración, también se debe de tener en cuenta el conjunto de cámaras y laser para realizar la medición.

1.3. Opciones de diseño

El concepto de regulación mecánica y manual, sitúa a los diferentes puntos de apoyo como el primer punto a tratar. La definición de estos puntos permite la creación del modelo, limitado por factores estructurales, de fabricación, libertad de movimiento, montaje y espacio útil.

Los diferentes puntos de apoyos integrados en el diseño deben obtener una influencia en la zona de medición mínima o inexistente. Añadiendo que no pueden modificar ni dañar el elemento a calibrar.

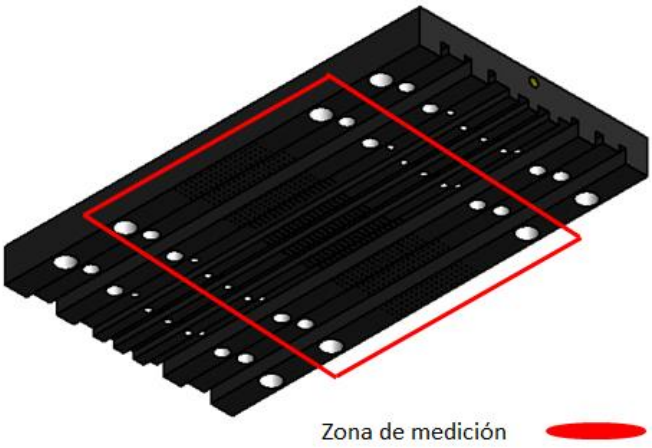


Figura 8: Zona de medición.

Las zonas de amarre de estos puntos de apoyo se deben de situar en la parte superior o en la inferior de la mesa de calibración, dependiendo de las limitaciones de cada área de apoyo. En la siguiente imagen se muestran las dos áreas evaluadas para la realización de la regulación mecánica.

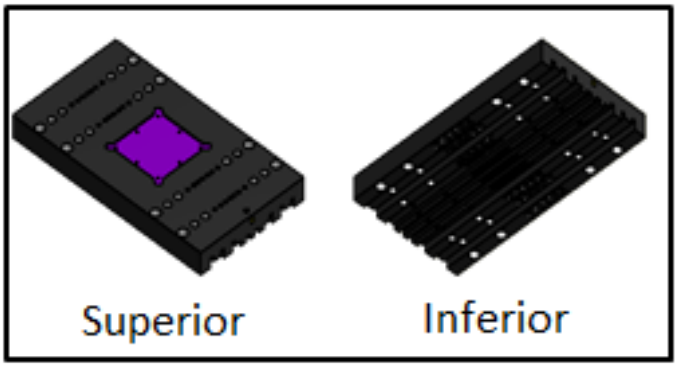


Figura 9: Zona superior e inferior mesa de calibración.

Los primeros bocetos desarrollados para definir los puntos de apoyo se han centraron en el área superior, consiguiendo total libertad en la parte inferior donde se encuentra la zona de medición. Las dos opciones valoradas son:

Opción 1: Regulación con tres puntos de sujeción y un acople circular entre la placa y el sistema de regulación.

Opción 2: Bandeja de apoyo para la mesa de calibración regulada con un angular con 4 puntos de regulación.

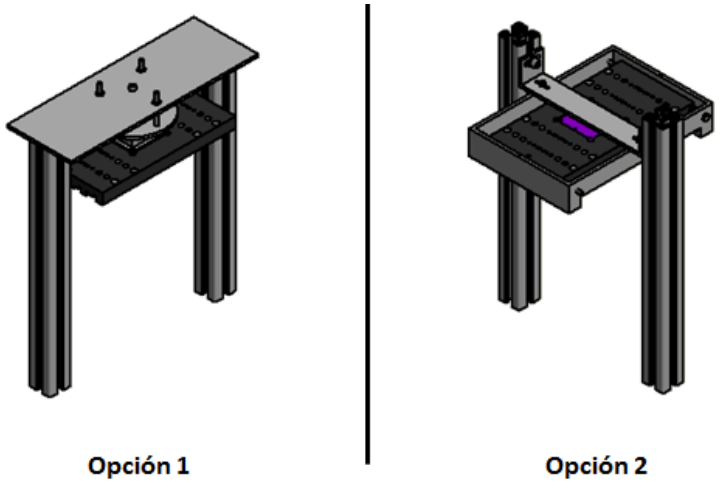


Figura 10: Opciones regulación en zona superior.

Estas dos opciones de amarre superior muestran diferentes factores limitantes, los cuales evidencian que el posicionamiento desde la parte superior no es el más indicado para este proceso de calibración. Los factores limitantes analizados son:

- Elevada complejidad de regulación, debido a la concentración en un área pequeña de todos los puntos de regulación para obtener los grados de movilidad.

- La disposición de una masa suspendida sobre los puntos de regulación, daría lugar a una regulación más imprecisa debido a que el elemento a calibrar no estaría en contacto directo con los puntos de regulación.

Debido a los factores definidos anteriormente, la opción de regulación superior no se ha implementado en el desarrollo del presente proyecto.

Las zonas que ofrecen mayor versatilidad y facilidad de reglaje son las caras laterales y las esquinas inferiores de la mesa de calibración. A diferencia de la regulación en la parte superior, esta regulación se realiza directamente sobre la mesa de calibración.

En la siguiente imagen se muestra los 10 puntos de apoyo que permitirían una regulación sencilla y mecánica del sistema.

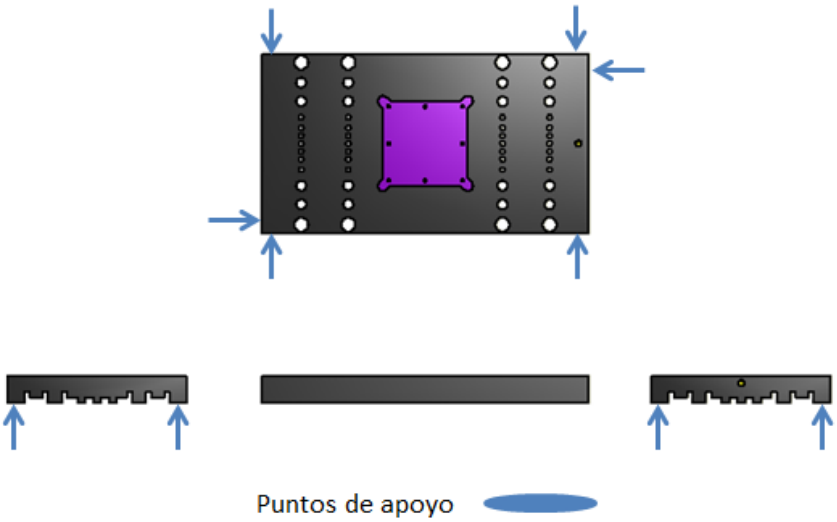


Figura 11: Opción regulación en zona inferior.

Una vez definida el área de apoyo, el proyecto debe orientarse hacia el diseño estructural de los componentes que permitirán desplazar la mesa de calibración en las tres direcciones espaciales.

1.4. Desarrollo concepto

Estructura resistente, compacta y versátil es el concepto a desarrollar. Integrando sistemas de regulación, elementos comerciales y piezas impresas en 3D.

1.4.1. Sistema de regulación

La regulación mecánica estructural está basada en tres sistemas mecánicos: tornillo-tuerca, conjunto muelle y posicionado.

El sistema **tornillo-tuerca**, se emplea en la conversión de un movimiento giratorio en un movimiento lineal continuo. El sistema utilizado se basa en una tuerca fija que produce el avance del tornillo cuando este gira, este avance depende de dos factores:

- Rotación del tornillo [V]: movimiento rotatorio del tornillo respecto al eje.
- Paso de la rosca [P]: Distancia sucesiva entre dos crestas del tornillo.

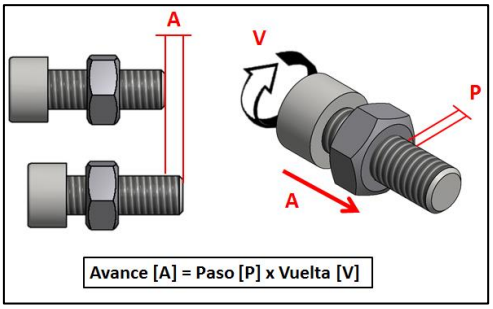


Figura 12: Sistema tornillo-tuerca.

El sistema **conjunto muelle**, es un ensamblaje formado por tornillo, tuerca y resorte elástico (o muelle) cuya función es devolver la pieza a su posición inicial y mantener el sistema en tensión constante. El siguiente esquema permite mostrar una idea del conjunto y de su funcionalidad.

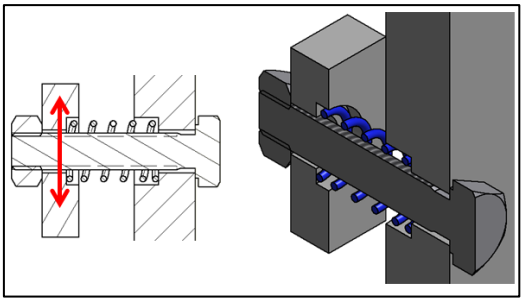


Figura 13: Sistema conjunto muelle.

El sistema de **posicionado**, consiste en la utilización del sistema conjunto muelle unido a un sistema de regulación por tornillo más tuerca. Facilita el montaje y centrado inicial de la mesa de calibración, la adición de la pieza en forma de escuadra se amolda al lateral de la mesa para limitar la posición en esa dirección.

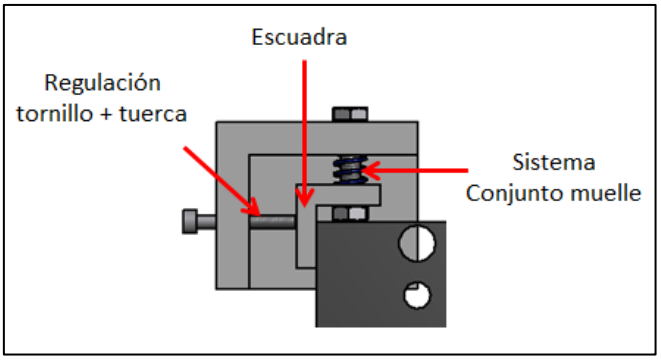


Figura 14: Sistema posicionamiento inicial.

La regulación mecánica es la combinación de los tres sistemas nombrados anteriormente, situados en las cuatro esquinas de la mesa de calibración.

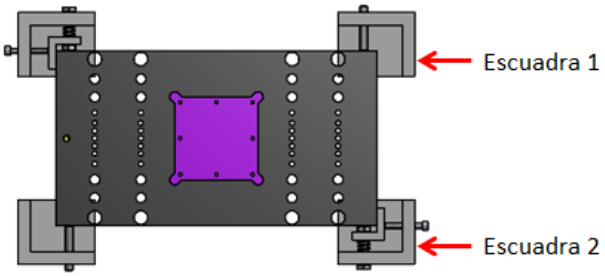


Figura 15: Sistema de regulación global.

Se dividen en dos subconjuntos:

- Escuadra 1: Sistema tornillo-tuerca para la regulación en el plano vertical y horizontal.

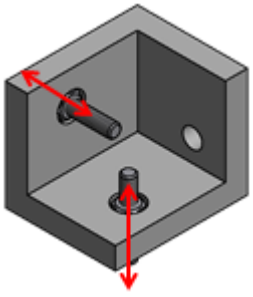


Figura 16: Escuadra de regulación 1.

- Escuadra 2: Sistema tornillo-tuerca, conjunto muelle y posicionado para la regulación en el plano vertical añadiendo una rigidez al sistema para devolver su posición inicial.

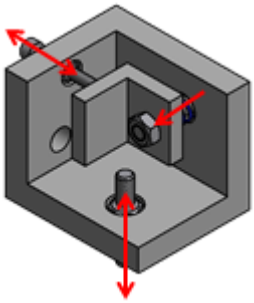


Figura 17: Escuadra de regulación 2.

1.4.2. Fabricación componentes

La versatilidad de diseño y la facilidad de producción utilizando la impresión en 3D como proceso de fabricación, ha permitido crear un total de seis piezas con material PLA inyectado de diámetro 1,75mm. [ANEXO PLANOS]

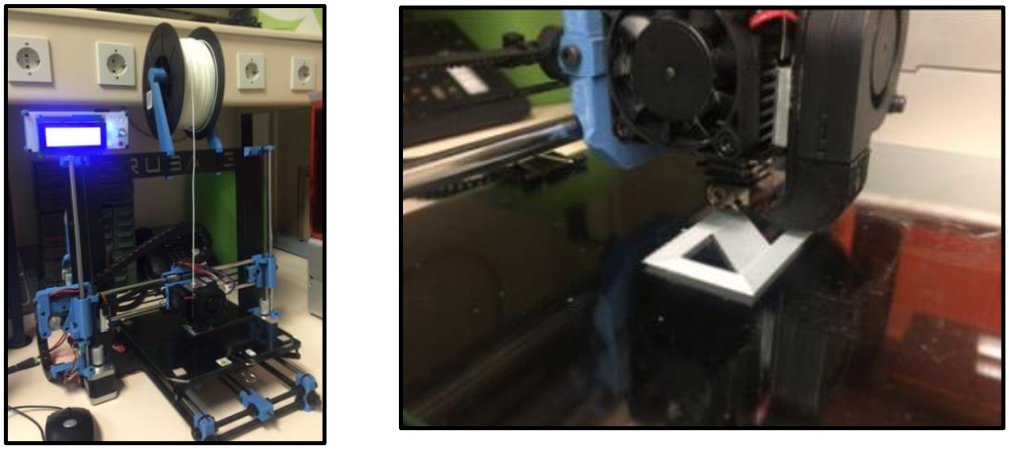


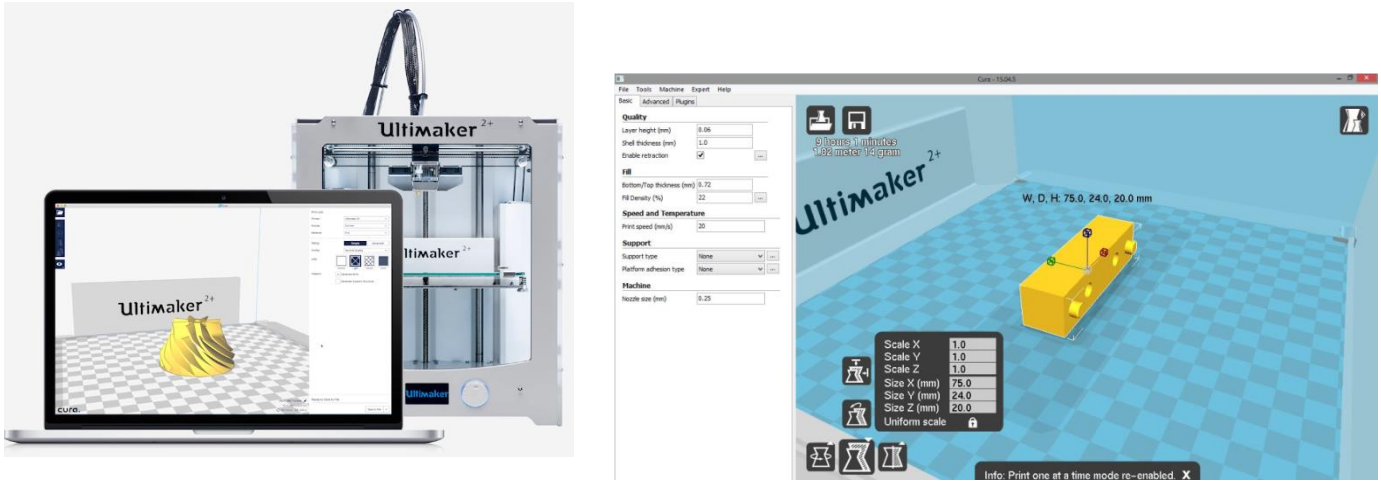
Figura 18: Proceso de impresión 3D.

Figura 19: Componentes impresos en 3D.

La fabricación de las piezas en materiales más resistentes, como Aluminio o Acero, era la idea preliminar, no obstante el proceso de impresión 3D ha permitido la fabricación con una resistencia idónea para el sistema de regulación. Diferentes componentes comerciales han sido integrados en los alojamientos diseñados en las piezas, a través de métodos de fijación como adhesivo líquido.

El desarrollo del diseño de las piezas estructurales se ha realizado a través del software 3D Inventor, este software ofrece herramientas profesionales para el diseño mecánico, la documentación y la simulación 3D.

Las piezas han sido diseñadas e integradas en el diseño final con sus respectivos planos, siendo importadas en formato ".gcode" para ser procesadas con el software apropiado de la impresora 3D. El software utilizado para procesar e imprimir las piezas en la impresora 3D ha sido "Cura 15.04.5", prepara los modelos para ser impresos haciendo fácil la obtención de resultados óptimos.



. Figura 20: Interfaz software Cura

1.4.3. Elementos comerciales

En el actual proyecto se han integrado diferentes componentes comerciales para su utilización en la estructura general y en los sistemas de regulación.

En la **estructura general**, se han utilizado componentes estructurales como perfiles de aluminio y sistemas de sujeción como escuadras y tornillos.

- Perfiles de aluminio: Dimensiones 40x40mm del fabricante BoschRexroth.
- Escuadras: Dimensiones 40x40mm del fabricante BoschRexroth.

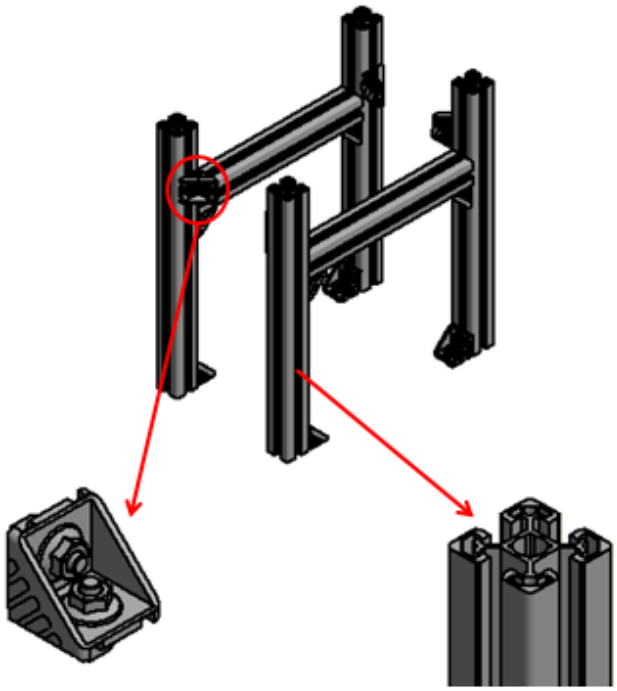


Figura 21: Elementos comerciales estructura general.

Estos componentes comerciales proporcionan un montaje sencillo y de elevada resistencia permitiendo libertad de movimientos.

La información de los elementos comerciales queda detallada en el Anexo "Equipamiento Comercial".

En los sistemas de **regulación** se han utilizado los siguientes componentes:

- Tornillos: DIN 912 (Métrica 4, 6 y 8)

  DIN 933 (Nylon, Métrica 6)

- Tuercas: DIN 934 (Métrica 4 y 6).

  DIN 934 (Nylon, Métrica 6).

- Resorte elástico: Muelle diámetro ext. 8mm y diámetro alambre 1mm.

La utilización de materiales, como el nylon, permite el contacto directo con el elemento a calibrar evitando cualquier tipo de daño sobre la superficie.

1.1. Diseño Final

Una vez evaluadas las diferentes opciones de diseño, el diseño final ha quedado totalmente definido. En este diseño se han integrado todos los componentes y elementos nombrados anteriormente.

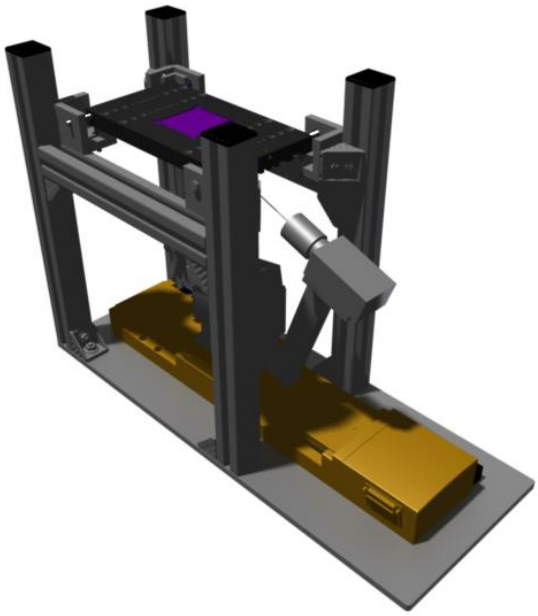


Figura 22 : Conjunto General

Las diferentes áreas que componen el diseño final son las siguientes:

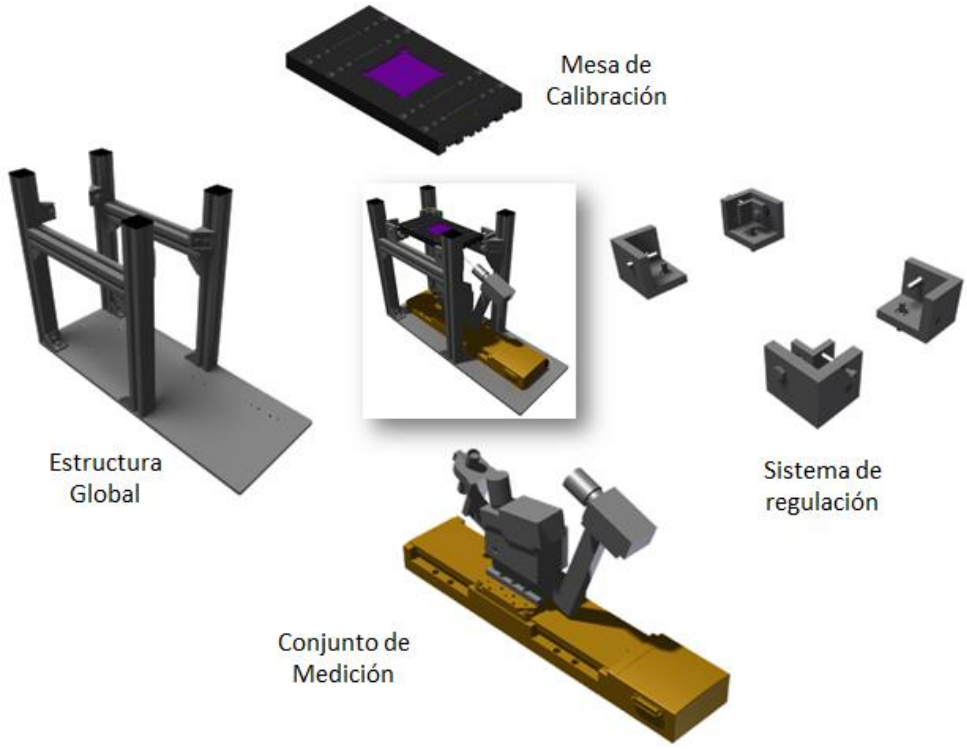


Figura 23: Componentes estructura general

Anexo III: Componentes

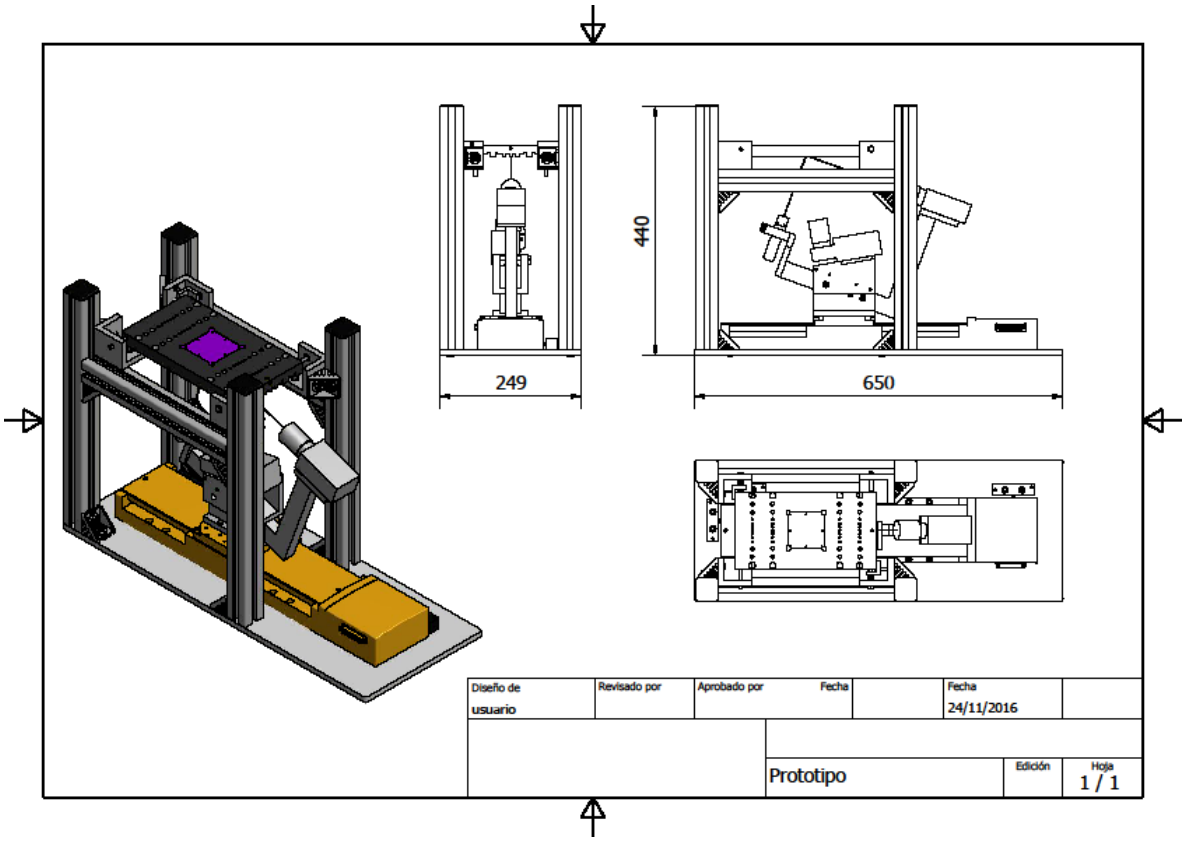
En el actual proyecto se han integrado diferentes componentes para su utilización en la estructura general y en los sistemas de regulación.

1. Componentes diseñados

Los componentes diseñados en 3D y fabricados posteriormente son los siguientes:

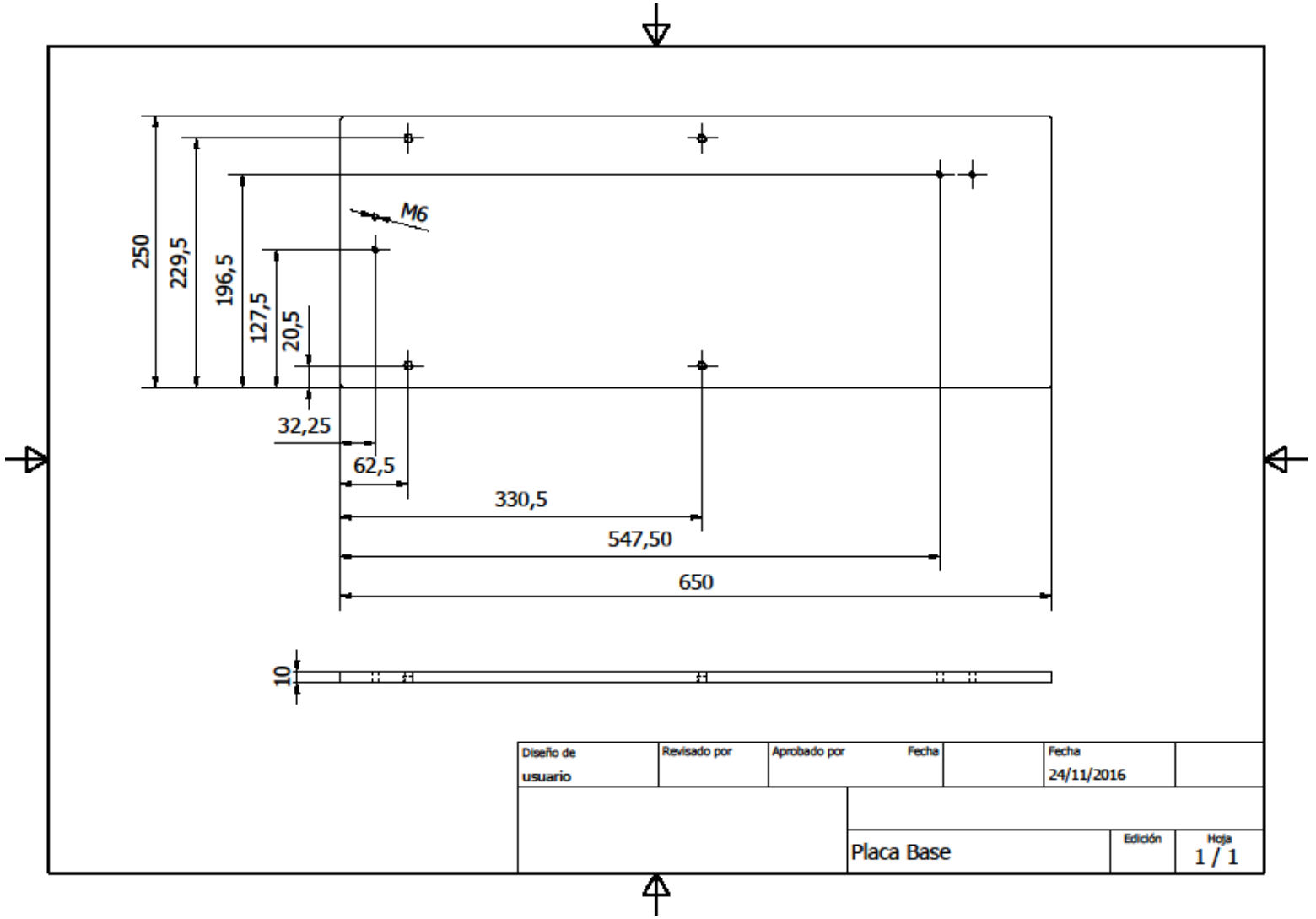
- Placa Base
- Escuadra 1
- Escuadra 2
- Angular

La siguiente figura muestra las dimensiones globales de todo el sistema.

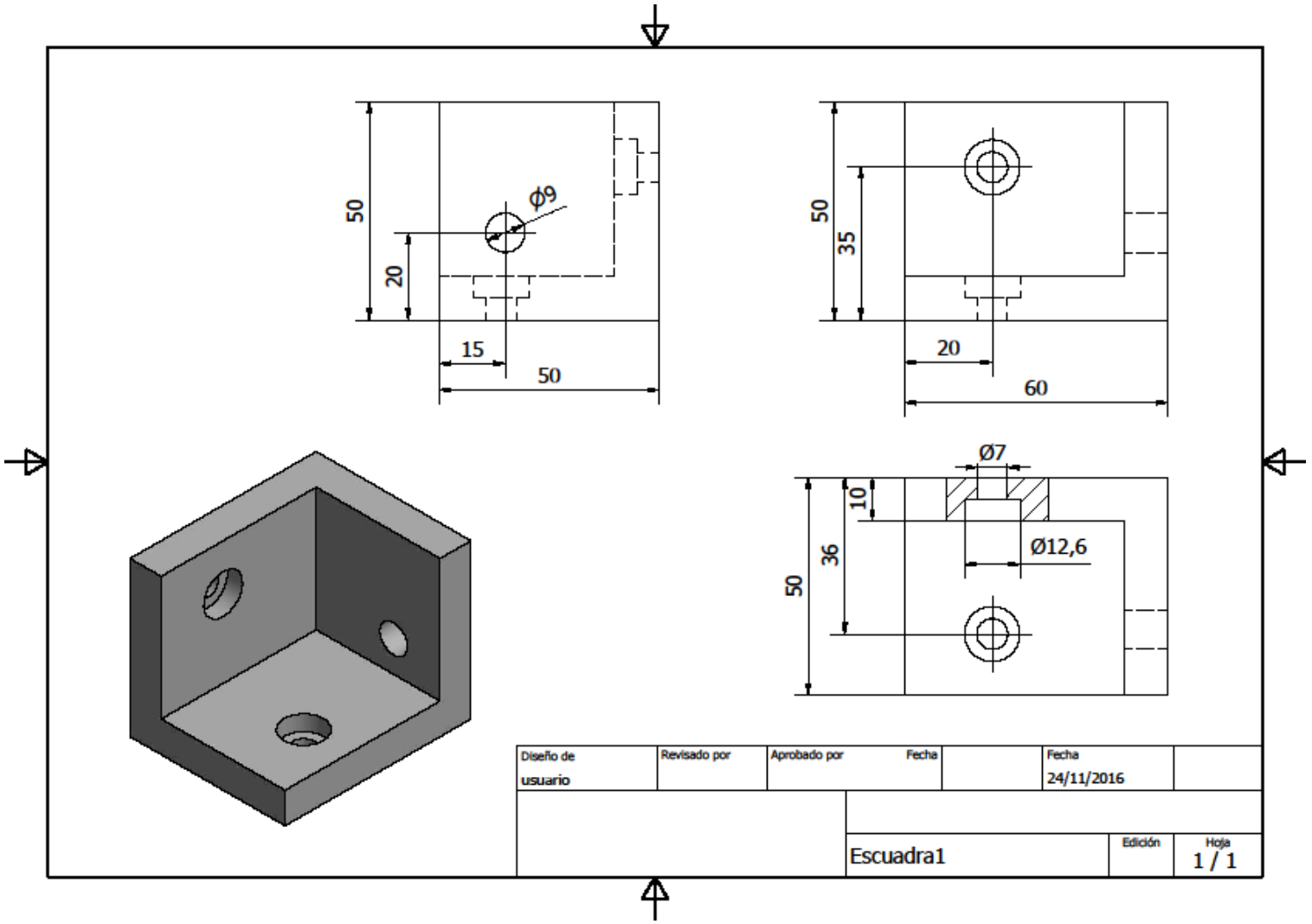


A continuación se exponen los planos mecánicos de las piezas diseñadas y fabricadas, con sus dimensiones globales.

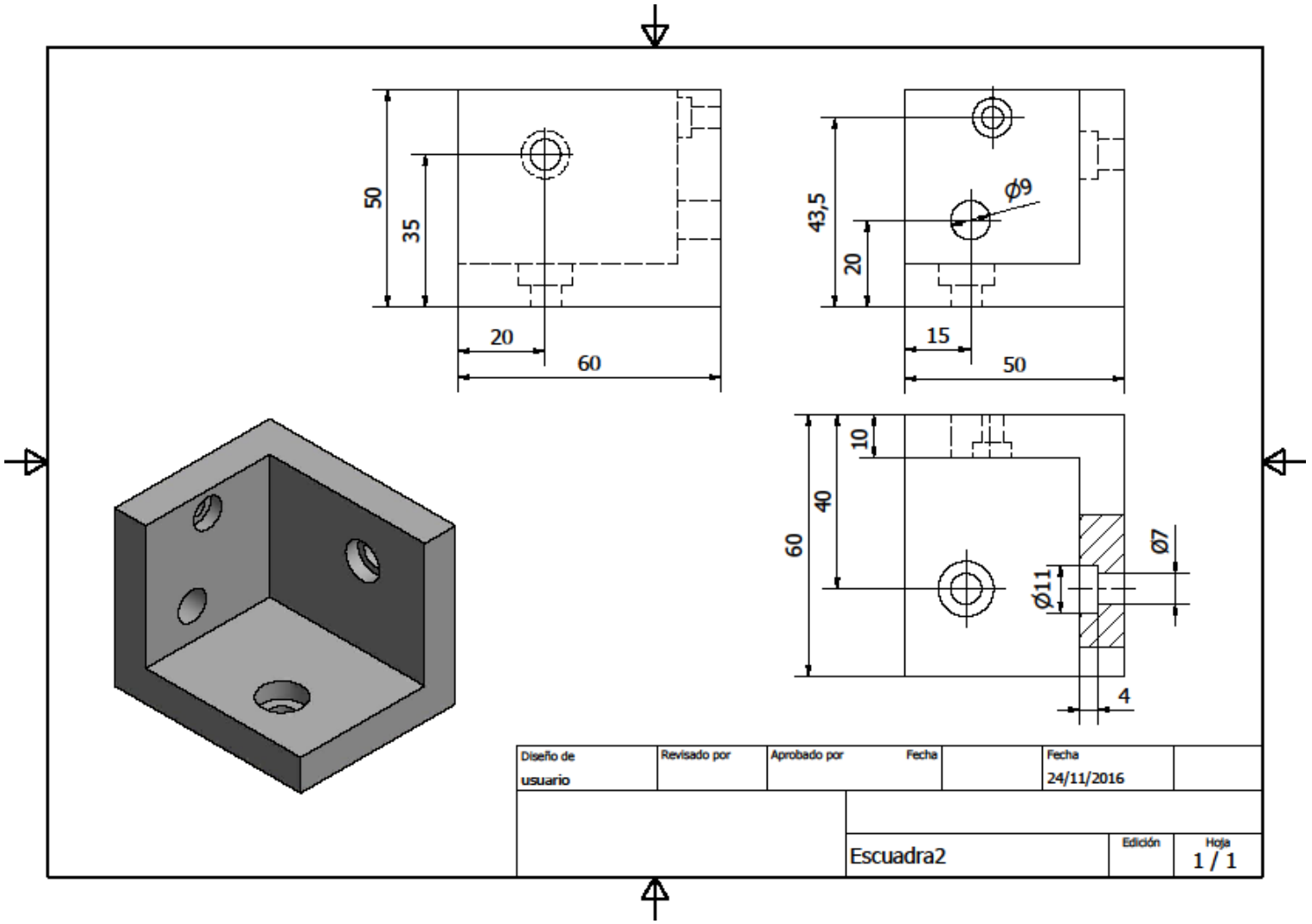
Placa Base


M6
250
229,5
196,5
127,5
20,5
32,25
62,5
330,5
547,50
650
10
Diseño de
usuario
Revisado por
Aprobado por
Fecha
Fecha
24/11/2016
Placa Base
Edición
Hoja
1 / 1

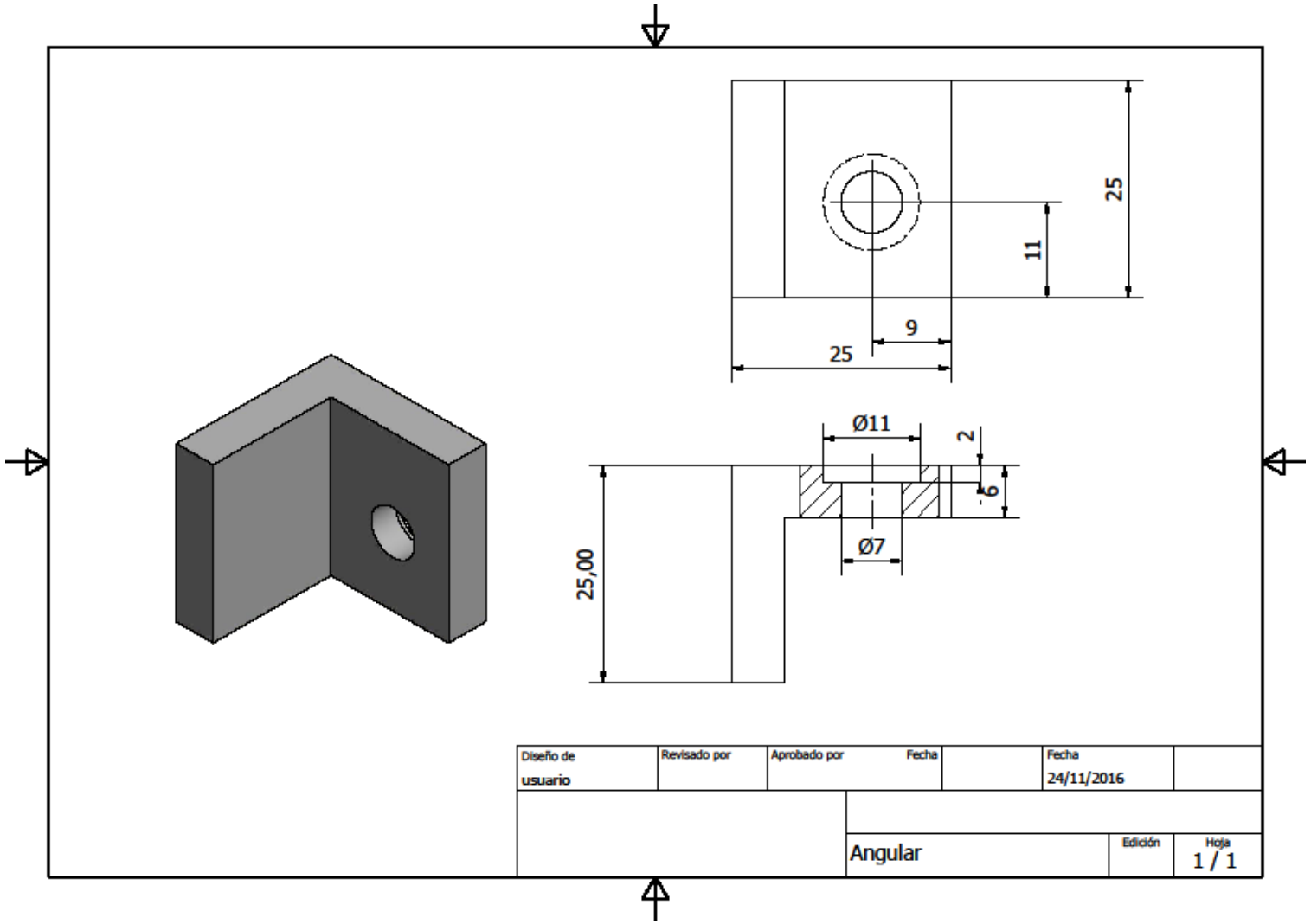
Escuadra 1


50
ϕ9
20
15
50
50
35
20
60
Ø7
10
36
50
Ø12,6
Diseño de
usuario
Revisado por
Aprobado por
Fecha
Fecha
24/11/2016
Escuadra1
Edición
Hoja
1 / 1

Escuadra 2


50
35
20
60
43,5
20
Ø9
15
50
60
40
10
Ø11
Ø7
4
Diseño de
usuario
Revisado por
Aprobado por
Fecha
Fecha
24/11/2016
Escuadra2
Edición
Hoja
1 / 1

Angular

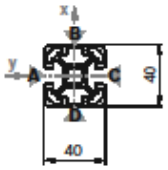

25
11
9
25
Ø11
2
6
Ø7
25,00
Diseño de
usuario
Revisado por
Aprobado por
Fecha
Fecha
24/11/2016
Angular
Edición
Hoja
1 / 1

2. Componentes comerciales

- Perfiles BoschRexroth 40x40mm.

40x40L 2N

A = 6,0 cm²
I_x = 9,0 cm⁴
I_y = 10,3 cm⁴
W_x = 4,5 cm³
W_y = 5,2 cm³
m = 1,6 kg/m



Tapa: véase 40x40

40x40L 2N		L (mm)	N.º
1 ud.		50 ... 6000	3 842 993 187 / L
1 ud.	M12 M12	110 ... 6000	3 842 993 188 / L
20 uds.		6070	3 842 529 363

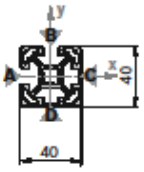
Quick & Easy (pág. 2-8, véanse los despiegables)

40x40L 2N	3 842 993 720 / ...
Longitud L (mm)	50 ... 6000
Mecanizado estándar de perfiles (observar la longitud mínima, pág. 2-24)	M12 / D9,8 / D17 / DB17
Mecanizado personalizado de perfiles ($L_{máx}$ = 5400 mm)	DI / DIS / MT / MTS / MI / MIS / DG[1]

[1] $DG_{máx}$ = 45°; $L_{mín1}$ / $L_{mín2}$ = 370 / 440 mm

40x40L 2NVS

A = 6,0 cm²
I_x = 9,7 cm⁴
I_y = 9,7 cm⁴
W_x = 4,9 cm³
W_y = 4,9 cm³
m = 1,6 kg/m



Tapa: véase 40x40

40x40L 2NVS		L (mm)	N.º
1 ud.		50 ... 6000	3 842 993 189 / L
1 ud.	M12 M12	110 ... 6000	3 842 993 190 / L
20 uds.		6070	3 842 529 365

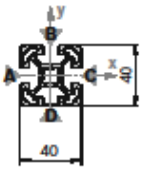
Quick & Easy (pág. 2-8, véanse los despiegables)

40x40L 2NVS	3 842 993 721 / ...
Longitud L (mm)	50 ... 6000
Mecanizado estándar de perfiles (observar la longitud mínima, pág. 2-24)	M12 / D9,8 / D17 / DB17
Mecanizado personalizado de perfiles ($L_{máx}$ = 5400 mm)	DI / DIS / MT / MTS / MI / MIS / DG[1]

[1] $DG_{máx}$ = 45°; $L_{mín1}$ / $L_{mín2}$ = 370 / 440 mm

40x40L 3N

A = 5,8 cm²
I_x = 9,7 cm⁴
I_y = 9,0 cm⁴
W_x = 4,8 cm³
W_y = 4,5 cm³
m = 1,6 kg/m



Tapa: véase 40x40

40x40L 3N		L (mm)	N.º
1 ud.		50 ... 6000	3 842 993 191 / L
1 ud.	M12 M12	110 ... 6000	3 842 993 192 / L
20 uds.		6070	3 842 529 367

Quick & Easy (pág. 2-8, véanse los despiegables)

40x40L 3N	3 842 993 722 / ...
Longitud L (mm)	50 ... 6000
Mecanizado estándar de perfiles (observar la longitud mínima, pág. 2-24)	M12 / D9,8 / D17 / DB17
Mecanizado personalizado de perfiles ($L_{máx}$ = 5400 mm)	DI / DIS / MT / MTS / MI / MIS / DG[1]

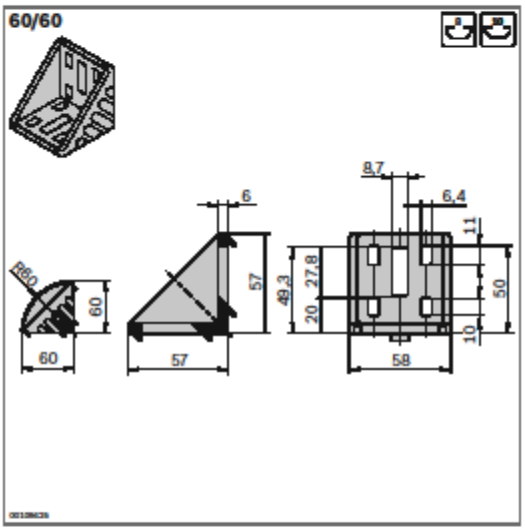
[1] $DG_{máx}$ = 45°; $L_{mín1}$ / $L_{mín2}$ = 370 / 440 mm

Bosch Rexroth AG, 3 842 540 395 (2013-02)
DBR AUTOMATION, SL: C/ Jalón, 25. 29004 Málaga. Telf: 951 70 94 74, Fax: 951 21 57 17, E-mail: comercial@dbrautomation.com

Información detallada en: https://www.boschrexroth.com/es/es/.

- Escuadras BoschRexroth

60/60



60/60	Ranura	ESD		N.º	FS
Juego (estándar)	8 / 8		1	**3 842 523 549**	8xFS2
	8 / 10		1	**3 842 523 551**	4xFS2, 1xFS5
	10 / 10		1	**3 842 523 553**	2xFS5
Juego *designLINE*	8 / 8		1	**3 842 538 713**	8xFS2
	8 / 10		1	**3 842 538 714**	4xFS2, 1xFS5
	10 / 10		1	**3 842 538 715**	2xFS5
Escuadra (estándar)	8		20	**3 842 523 546**	
Tapa			20	**3 842 523 555**	
Pieza intermedia para ranura de 10 mm	10		100	**3 842 523 537**	

Material: Escuadra: fundición a presión de aluminio, pulida
Escuadra *designLINE*: lacada (RAL 9006)
Tapa, pieza intermedia: PA; negro
Material de fijación: acero; galvanizado

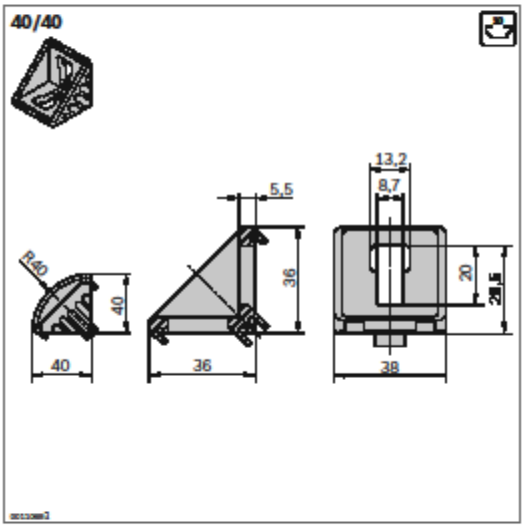
Volumen de suministro: Juego (estándar): escuadra, material de fijación (FS)
Juego *designLINE*: escuadra *designLINE*, tapa, material de fijación (FS)

Mod.	Ranura	F_{max}	M_{max}	M_{max}	M_{max}
60/60	8	5000 N	320 Nm	370 Nm	110 Nm
	10	3000 N	125 Nm	150 Nm	–

FS2

FS5

40/40



40/40	Ranura	ESD		N.º	FS
Juego (estándar)	10 / 10		1	**3 842 529 383**	2xFS5
Juego *designLINE*	10 / 10		1	**3 842 538 716**	2xFS5
Escuadra (estándar)	10		100	**3 842 528 967**	
Tapa			100	**3 842 529 007**	

Material: Escuadra: fundición a presión de aluminio, pulida
Escuadra *designLINE*: lacada (RAL 9006)
Tapa: PA; negro
Material de fijación: acero; galvanizado

Volumen de suministro: Juego (estándar): escuadra, material de fijación (FS)
Juego *designLINE*: escuadra *designLINE*, tapa, material de fijación (FS)

Modelo	F_{max}	M_{max}	M_{max}	M_{max}
40/40	3000 N	55 Nm	145 Nm	35 Nm

FS5

Bosch Rexroth AG, 3 842 540 395 (2013-02)

DBR AUTOMATION, SL: C/ Jalón, 25. 29004 Málaga. Telf: 951 70 94 74, Fax: 951 21 57 17, E-mail: comercial@dbrautomation.com

Información detallada en: https://www.boschrexroth.com/es/es/.

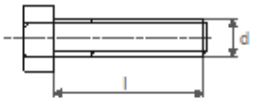
- Equipamiento de nylon:
  - Tornillos M6 : DIN 933

TORNILLERÍA DE NYLON

NYLON FASTENERS · VISSERIE NYLON · PARAFUSOS DE NYLON

OpaC

DIN 34810 (DIN 931)*



Tornillo hexagonal con rosca parcial
Hexagonal screws
Vis à tête hexagonale filetage partiel
Parafuso hexagonal com rosca parcial

***Similar a DIN 34810 (antigua DIN 931)**
**Similar to DIN 34810 (former DIN 931)*
*Similaire DIN 34810 (ancienne DIN 931)
**Semelhante DIN 34810 (antiga DIN 931)*

Material estándar: Poliamida
Standard material: Polyamide
Matière standard: Polyamide
Material padrão: Poliamida

Color: Blanco natural
Colour: Natural
Couleur: Blanc naturel
Cor: Branco natural

Longitud de la rosca
Length of thread
Longueur du filetage
Comprimento da rosca

Otros materiales, dimensiones y colores RAL o especiales bajo consulta.
Other materials, dimensions and RAL or special colours upon request.
Sur demande autres matières, dimensions, couleurs RAL ou spéciaux.
Outros materiais, dimensões e cores RAL ou especiais, disponíveis sob consulta.

d	M3		M4		M5		M6		M8		M10		M12		M16		d
l (═)	14	(12)	35	(30)	18	(17)	35	(30)	26	(20)	13	(8)	70	(60)	35	(30)	l (═)
	22	(20)	45	(40)	55	(40)	55	(50)	55	(50)	14	(4)	75	(60)	45	(40)	
	28	(18)	50	(40)	60	(40)	60	(55)	70	(65)	45	(40)	80	(40)	50	(40)	
	34	(30)	55	(30)	65	(50)	65	(55)	75	(65)	55	(50)	90	(50)	55	(40)	
	40	(12)	60	(30)	70	(50)	70	(55)	80	(65)	60	(50)	100	(60)	65	(50)	
	45	(30)	70	(30)	80	(40)	75	(50)	90	(65)	65	(50)			75	(70)	
							80	(50)	100	(65)	70	(50)			80	(70)	
							90	(50)	110	(65)	80	(50)			90	(70)	
							100	(50)			85	(50)					
											100	(50)					

Artículo bajo consulta sujeto a cantidades mínimas.
Item being searched is subject to a minimum order.
Produit sur demande avec quantités minimum.
Artigo disponível disponível sob consulta, sujeito a quantidades mínimas.

Ref.?

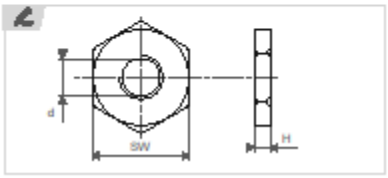
ejemplo
example
exemple
exemplo

DIN 931
M6x60

Ref. = 931N-6-60

- Tuercas M6 : DIN 934

ISO 4036 (DIN 439)*



Otros materiales, dimensiones y colores RAL o especiales bajo consulta.
Other materials, dimensions and RAL or special colours upon request.
Sur demande autres matières, dimensions, couleurs RAL ou spécieux.
Outros materiais, dimensões e cores RAL ou especiais, disponíveis sob consulta.

Tuerca baja hexagonal de nylon
Hexagonal nuts
Ecrou hexagonal bas
Porca baixa hexagonal de nylon

***Similar a ISO 4036 (antigua DIN 439)**
Similar to ISO 4036 (former DIN 439)
*Similaire ISO 4036 (ancienne DIN 439)
Semelhante ISO 4036 (antiga DIN 439)

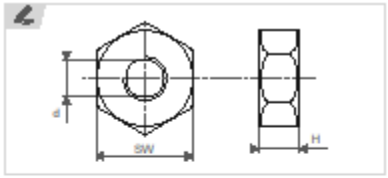
Material estándar: Poliamida
Standard material: Polyamide
Matière standard: Polyamide
Material padrão: Poliamida

Color: Negro
Colour: Black
Couleur: Noir
Cor: Preto

Ref.	d	SW	H
439N-8-100-13	M8 (x1,0)	13	4,0
439N-10-150-14	M10 (x1,5)	14	2,5
439N-10-75-14	M10 (x0,75)	14	2,5
439N-12-100-16	M12 (x1,0)	16	5,0
439N-12-100-17	M12 (x1,0)	17	4,0
439N-14-100-22	M14 (x1,0)	22	5,0

Ref.	d	SW	H
439N-14-150-22	M14 (x1,5)	22	5,0
439N-15-100-18	M15 (x1,0)	18	3,0
439N-16-100-24	M16 (x1,0)	24	4,0
439N-18-100-24	M18 (x1,0)	24	4,0
439N-20-150-27	M20 (x1,5)	27	8,0
439N-30-150-36	M30 (x1,5)	36	5,0

DIN 34814 (DIN 934/555)*



Otros materiales, dimensiones y colores RAL o especiales bajo consulta.
Other materials, dimensions and RAL or special colours upon request.
Sur demande autres matières, dimensions, couleurs RAL ou spécieux.
Outros materiais, dimensões e cores RAL ou especiais, disponíveis sob consulta.

****Medidas según antiguo estándar**
*****According to former DIN standard***
**Dimensions suivant ancienne norme
Medidas conforme o antigo padrão

Tuerca hexagonal de nylon
Hexagonal nuts
Ecrou hexagonal nylon
Porca hexagonal de nylon

***Similar a DIN 34814 (antigua DIN 934/555)**
Similar to DIN 34814 (former DIN 934/555)
*Similaire DIN 34814 (ancienne DIN 934/555)
Semelhante DIN 34814 (antiga DIN 934/555)

Material estándar: Poliamida
Standard material: Polyamide
Matière standard: Polyamide
Material padrão: Poliamida

Color: Blanco natural
Color: Natural
Couleur: Blanc naturel
Cor: Branco natural

Ref.	d	H	SW
934N-2	M2	1,2	4
934ND-2,5	M2,5	1,8	5
934N-3	M3	2,15-2,4	6
934N-4	M4	3,2	7
934N-5	M5	4,0	8
934N-6	M8	5,0	10
934N-8	M8	6,4	13

Ref.	d	H	SW
934N-10	M10	8,0	17**
934N-12	M12	10,1	19**
934N-14	M14	12,8	21
934N-16	M16	14,8	24
934N-20	M20	18,0	30
934N-24	M24	21,5	36

- Equipamiento metálico:
  - Tonillos M6: DIN 912

2. Tornillería Allen.

DIN 912

TORNILLO CABEZA ALLEN

d	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M24
D	5,5	7	8,5	10	13	16	18	21	24	27	30	36
s	2,5	3	4	5	6	8	10	12	14	14	17	19
k	3	4	5	6	8	10	12	14	16	18	22	24
b	18	20	22	24	28	32	36	40	44	48	52	60
e	-	3,44	4,58	5,72	6,86	9,15	11,43	13,72	16,00	16,00	19,44	21,73

Calidad 8.8 Ref. Catálogo	Calidad 12.9 Ref. Catálogo	Calidad Inox. Ref. Catálogo	Medidas d x L
13011099	13011320	13011641	3x6
13011100	13011321	13011642	3x8
13011101	13011322	13011643	3x10
13011102	13011323	13011644	3x12
13011103	13011324	13011645	3x14
13011104	13011325	13011646	3x16
13011105	13011326	13011647	3x20
13011106	13011327	13011648	3x25
13011107	13011328	13011649	3x30
13011108	13011329	13011650	3x35
13011109	13011330	13011651	4x6
13011110	13011331	13011652	4x8
13011111	13011332	13011653	4x10
13011112	13011333	13011654	4x12
13011113	13011334	13011655	4x14
13011114	13011335	13011656	4x16
13011116	13011338	13011657	4x18
13011118	13011337	13011658	4x20
13011117	13011338	13011659	4x22
13011118	13011339	13011660	4x25
13011119	13011340	13011661	4x30
13011120	13011341	13011662	4x35
13011121	13011342	13011663	4x40
13011122	13011343	13011664	4x45
13011123	13011344	13011665	4x50
13011124	13011345	13011666	5x8
13011125	13011346	13011667	5x10
13011126	13011347	13011668	5x12
13011127	13011348	13011669	5x14
13011128	13011349	13011670	5x16
13011129	13011350	13011671	5x18
13011130	13011351	13011672	5x20
13011131	13011352	13011673	5x22
13011132	13011353	13011674	5x25
13011133	13011354	13011675	5x30
13011134	13011355	13011676	5x35
13011135	13011356	13011677	5x40
13011136	13011357	13011678	5x45
13011137	13011358	13011679	5x50
13011138	13011359	13011680	5x55
13011139	13011360	13011681	5x60
13011140	13011361	13011682	5x65
13011141	13011362	13011683	6x8
13011142	13011363	13011684	6x10

Calidad 8.8 Ref. Catálogo	Calidad 12.9 Ref. Catálogo	Calidad Inox. Ref. Catálogo	Medidas d x L
13011143	13011364	13011685	6x12
13011144	13011365	13011686	6x14
13011145	13011366	13011687	6x16
13011146	13011367	13011688	6x18
13011147	13011368	13011689	6x20
13011148	13011369	13011690	6x22
13011149	13011370	13011691	6x25
13011150	13011371	13011692	6x30
13011151	13011372	13011693	6x35
13011152	13011373	13011694	6x40
13011153	13011374	13011695	6x45
13011154	13011375	13011696	6x50
13011155	13011376	13011697	6x55
13011156	13011377	13011698	6x60
13011157	13011378	13011699	6x65
13011158	13011379	13011700	6x70
13011159	13011380	13011701	6x80
13011160	13011381	13011702	6x90
13011161	13011382	13011703	6x100
13011162	13011383	13011704	8x10
13011163	13011384	13011705	8x12
13011164	13011385	13011706	8x14
13011165	13011386	13011707	8x16
13011166	13011387	13011708	8x18
13011167	13011388	13011709	8x20
13011168	13011389	13011710	8x22
13011169	13011390	13011711	8x25
13011170	13011391	13011712	8x30
13011171	13011392	13011713	8x35
13011172	13011393	13011714	8x40
13011173	13011394	13011715	8x45
13011174	13011395	13011716	8x50
13011176	13011396	13011717	8x55
13011178	13011397	13011718	8x60
13011177	13011398	13011719	8x65
13011178	13011399	13011720	8x70
13011179	13011400	13011721	8x80
13011180	13011401	13011722	8x90
13011181	13011402	13011723	8x100
13011182	13011403	13011724	8x110
13011183	13011404	13011725	8x120
13011184	13011405	13011726	8x130
13011185	13011406	13011727	8x140
13011186	13011407	13011728	8x150

Calidad 8.8 Ref. Catálogo	Calidad 12.9 Ref. Catálogo	Calidad Inox. Ref. Catálogo	Medidas d x L
13011187	13011408	13011629	8x160
13011188	13011409	13011630	10x16
13011189	13011410	13011631	10x18
13011190	13011411	13011632	10x20
13011191	13011412	13011633	10x25
13011192	13011413	13011634	10x30
13011193	13011414	13011635	10x35
13011194	13011415	13011636	10x40
13011195	13011416	13011637	10x45
13011196	13011417	13011638	10x50
13011197	13011418	13011639	10x55
13011198	13011419	13011640	10x60
13011199	13011420	13011641	10x65
13011200	13011421	13011642	10x70
13011201	13011422	13011643	10x80
13011202	13011423	13011644	10x90
13011203	13011424	13011645	10x100
13011204	13011425	13011646	10x110
13011205	13011426	13011647	10x120
13011206	13011427	13011648	10x130
13011207	13011428	13011649	10x140
13011208	13011429	13011650	10x150
13011209	13011430	13011651	10x160
13011210	13011431	13011652	10x180
13011211	13011432	13011653	12x20
13011212	13011433	13011654	12x25
13011213	13011434	13011655	12x30
13011214	13011435	13011656	12x35
13011215	13011436	13011657	12x40
13011216	13011437	13011658	12x45
13011217	13011438	13011659	12x50
13011218	13011439	13011660	12x55
13011219	13011440	13011661	12x60
13011220	13011441	13011662	12x65
13011221	13011442	13011663	12x70
13011222	13011443	13011664	12x80
13011223	13011444	13011665	12x90
13011224	13011445	13011666	12x100
13011225	13011446	13011667	12x110
13011226	13011447	13011668	12x120
13011227	13011448	13011669	12x130
13011228	13011449	13011670	12x140
13011229	13011450	13011671	12x150
13011230	13011451	13011672	12x160

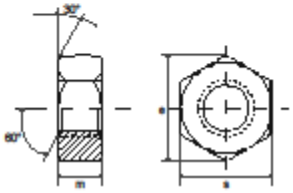
Continua en página siguiente

- Tuerca M6: DIN 934

TUERCAS

DIN 934

TUERCA HEXAGONAL



d1	M3	M4	M5	M6	M7	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30	M33	M36	M39	M42	M48
e	6,01	7,66	8,79	11,05	12,12	14,38	18,9	21,10	24,49	26,75	29,56	32,95	35,03	39,55	45,2	50,85	55,37	60,79	66,44	72,09	82,6
s	5,5	7	8	10	11	13	17	19	22	24	27	30	32	36	41	46	50	55	60	65	70
m	2,4	3,2	4	5	5,5	6,5	8	10	11	13	15	16	18	19	22	24	26	29	31	34	38

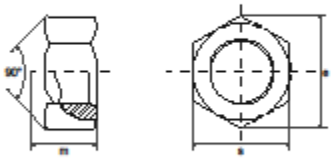
Calidad 8.8 Ref. catálogo	Calidad 10,9 Ref. catálogo	Calidad Zincado Ref. catálogo	Calidad Inox Ref. catálogo	Medidas sistema métrico
13020001	13020019	13020037	13020055	M3
13020002	13020020	13020038	13020056	M4
13020003	13020021	13020039	13020057	M5
13020004	13020022	13020040	13020058	M6
13020005	13020023	13020041	13020059	M8
13020006	13020024	13020042	13020060	M10
13020007	13020025	13020043	13020061	M12
13020008	13020026	13020044	13020062	M14
13020009	13020027	13020045	13020063	M16
13020010	13020028	13020046	13020064	M18

Calidad 8.8 Ref. catálogo	Calidad 10,9 Ref. catálogo	Calidad Zincado Ref. catálogo	Calidad Inox Ref. catálogo	Medidas sistema métrico
13020011	13020029	13020047	13020065	M20
13020012	13020030	13020048	13020066	M22
13020013	13020031	13020049	13020067	M24
13020014	13020032	13020050	13020068	M27
13020015	13020033	13020051	13020069	M30
13020016	13020034	13020052	13020070	M33
13020017	13020035	13020053	13020071	M36
13020018	13020036	13020054	13020072	M48

Consultar para otras medidas

DIN 985

TUERCA HEXAGONAL AUTOBLOCANTE



d1	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24	M27	M30	M36	M39
e	6,01	7,66	8,79	11,05	14,38	18,9	21,10	24,49	26,75	29,56	32,95	35,03	39,55	45,2	50,85	60,79	66,44
s	5,5	7	8	10	13	17	19	22	24	27	30	32	36	41	46	55	60
m	2,4	3,2	4	5	6,5	8	10	11	13	15	16	18	19	22	24	29	31

Calidad Zincado Ref. catálogo	Calidad Inox Ref. catálogo	Medidas sistema métrico
13020073	13020091	M3
13020074	13020092	M4
13020075	13020093	M5
13020076	13020094	M6
13020077	13020096	M7
13020078	13020096	M8
13020079	13020097	M10
13020080	13020098	M12
13020081	13020099	M14
13020082	13020100	M16

Calidad Zincado Ref. catálogo	Calidad Inox Ref. catálogo	Medidas sistema métrico
13020083	13020101	M18
13020084	13020102	M20
13020085	13020103	M22
13020086	13020104	M24
13020087	13020105	M27
13020088	13020106	M30
13020089	13020107	M36
13020090	13020108	M39

Consultar para otras medidas

Anexo IV: Resultados

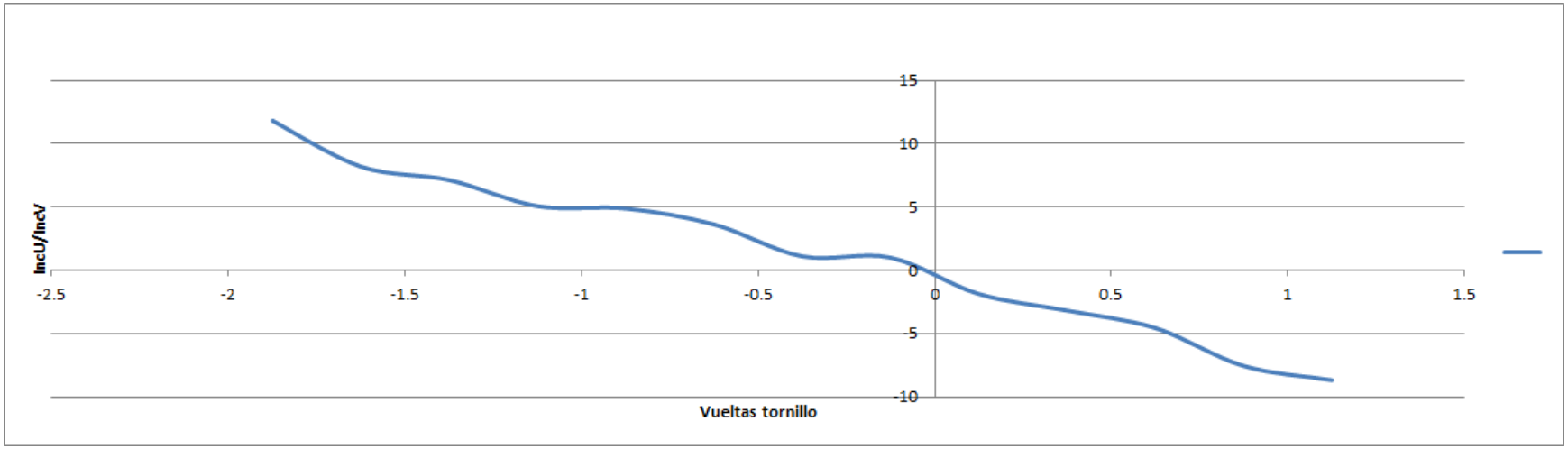
1. Caracterización

1.1. Ensayo Rotación Z, Tornillo1

Ensayo 1

TEST1 - TORNILLO1

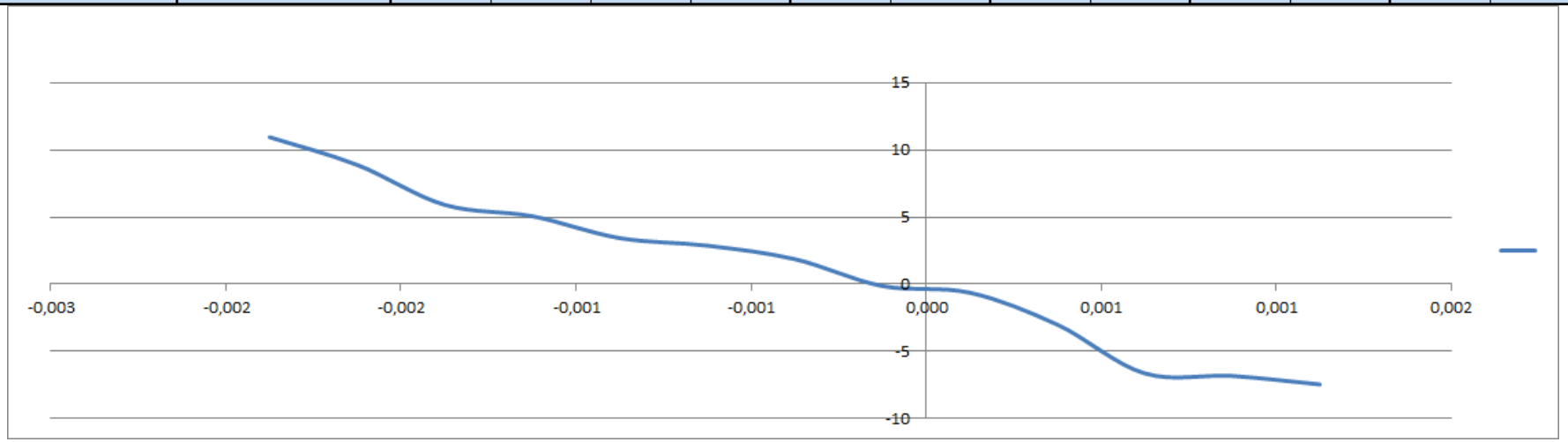
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	1	0.091	11.8125	1.25772367	89.6875	273.5	89.9375	1033.5625	90.5625	261	91.0625	1022.4375
1	0.25	0.9375	0.0853125	8.1875	0.87233031	89.5625	270.5	90.1875	1029.5625	90.6875	261.125	90.9375	1022.5625
2	0.50	0.9375	0.0853125	7.125	0.75868887	89.5625	266.875	90.0625	1027.9375	90.4375	260.125	91.0625	1020.4375
3	0.75	0.9375	0.0853125	5.0625	0.54035931	89.8125	266.625	89.9375	1023.5625	90.5625	259.625	91.0625	1020.4375
4	1.00	1	0.091	4.875	0.51893313	89.6875	264.625	90.1875	1024.5625	91.0625	258.75	90.8125	1020.6875
5	1.25	1.3125	0.1194375	3.625	0.385493	89.4375	262.5	90.0625	1023.5625	91.0625	258.25	91.0625	1020.5625
6	1.50	1.46771245	0.13356183	1.10002334	0.11710383	89.5625	259.75	89.5625	1019.4375	90.9979249	257.456203	91.0625	1019.53125
7	1.75	1.8125	0.1649375	1	0.10630793	88.9375	258.5	89.4375	1020.4375	90.9375	257.5	91.0625	1019.4375
8	2	1.25	0.11375	-1.875	-0.19932738	89.5625	255.625	89.3125	1017.6875	90.3125	257.625	91.0625	1019.4375
9	2.25	1.3125	0.1194375	-3.1875	-0.33894045	89.8125	254.625	88.9375	1015.4375	90.3125	256.875	91.0625	1019.5625
10	2.5	1.375	0.125125	-4.5625	-0.48546971	89.6875	252.625	89.6875	1012.4375	91.0625	255.75	91.0625	1018.4375
11	2.75	1.125	0.102375	-7.5625	-0.80441589	89.9375	249.625	89.6875	1010.6875	90.8125	256.75	91.0625	1018.6875
12	3	1.75	0.15925	-8.6875	-0.8175776	89.8125	248.125	88.9375	1009.5625	91.1875	255.625	91.0625	1017.4375



Ensayo 2

TEST1 - TORNILLO1

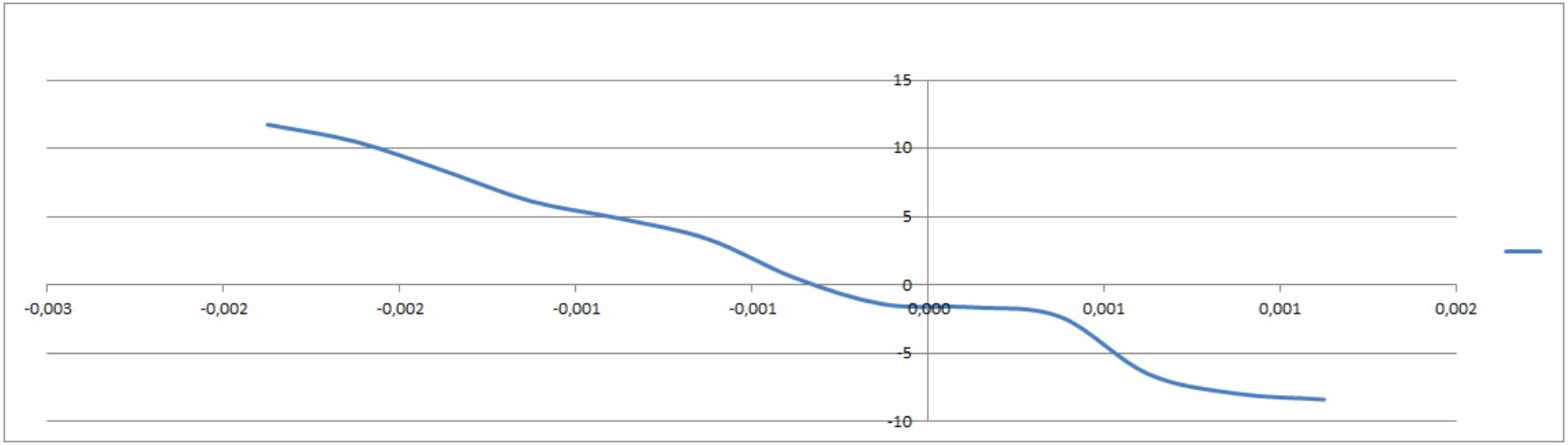
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	0.9375	0.0853125	10.9375	1.16379311	89.4375	272.375	90.0625	1033.6875	90.4375	261.5	90.9375	1022.6875
1	0.25	1.25	0.11375	8.875	0.94348414	89.6875	268.625	89.9375	1031.4375	91.0625	260.625	91.0625	1021.6875
2	0.50	0.875	0.079625	5.90625	0.62863007	89.6875	266.5625	90.1875	1026.5625	90.5625	259.625	91.0625	1021.6875
3	0.75	1.1875	0.1080625	5.0625	0.53902402	89.1875	264.75	89.8125	1025.3125	90.4375	259.5	90.9375	1020.4375
4	1.00	1.3125	0.1194375	3.4375	0.36558366	89.4375	262.5	89.9375	1023.5625	91.0625	258.5	90.9375	1020.6875
5	1.25	1.5	0.1365	2.875	0.30568546	88.9375	261.625	90.0625	1023.5625	91.0625	258.875	90.9375	1020.5625
6	1.50	1.3125	0.1194375	1.875	0.19909899	89.8125	258.625	89.0625	1022.3125	90.5625	257.625	90.9375	1019.5625
7	1.75	1.5	0.1365	-0.125	-0.01329176	89.6875	257.6875	89.9375	1019.3125	91.1875	257.6875	91.4375	1019.5625
8	2	2.0625	0.1876875	-0.625	-0.0666619	89.0625	255.625	89.0625	1017.5625	91.1875	258.75	91.0625	1015.6875
9	2.25	1.9375	0.1763125	-3	-0.31902848	89.0625	253.875	89.0625	1015.4375	90.9375	256.75	91.0625	1018.5625
10	2.5	2	0.182	-6.625	-0.7037147	89.0625	250.25	89.3125	1011.5625	91.1875	255.625	91.1875	1019.4375
11	2.75	1.6875	0.1535625	-6.8125	-0.72392588	89.0625	249.5	89.5625	1011.6875	90.9375	256.25	91.0625	1018.5625
12	3	1.5	0.1365	-7.4375	-0.79111963	89.6875	247.75	88.9375	1009.5625	90.9375	255.5	90.6875	1016.6875



Ensayo 3

TEST1 - TORNILLO1

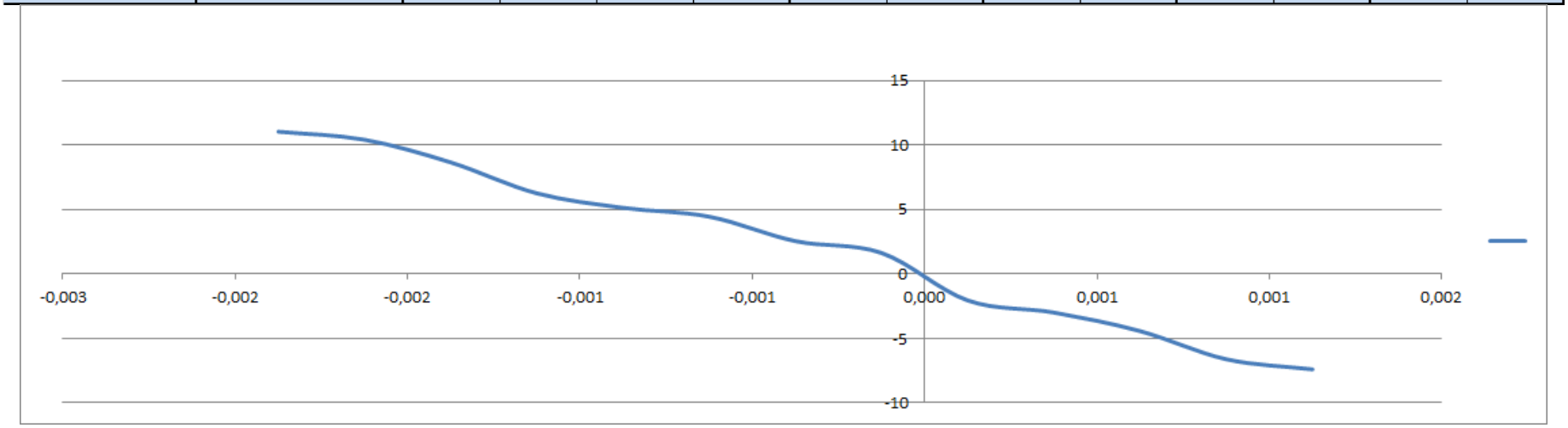
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_3	IncX	v	u	v	u	v	u	v	u
0	0.00	1	0.091	11.75	1.03633411	89.4375	270.5	90.1875	1033.5625	90.5625	261.75	91.0625	1022.8125
1	0.25	1.0625	0.0966875	10.5	1.11678296	89.4375	269.75	90.1875	1031.4375	90.9375	259.375	90.8125	1020.8125
2	0.50	1.3125	0.1194375	8.375	0.89135726	89.5625	268.75	89.9375	1028.0625	91.1875	258.625	90.9375	1021.4375
3	0.75	1.4375	0.1308125	6.125	0.65210003	89.5625	265.75	89.5625	1025.5625	91.0625	258.625	90.9375	1020.4375
4	1.00	1.125	0.102375	4.875	0.51816684	89.4375	264.375	90.1875	1025.5625	90.9375	258.625	90.9375	1021.5625
5	1.25	1.5625	0.1421875	3.375	0.35902503	89.4375	262.625	89.3125	1023.5625	90.8125	258.75	91.0625	1020.6875
6	1.50	1.4375	0.1308125	0.5	0.05317162	89.4375	257.5	89.5625	1020.6875	90.8125	258.5	91.0625	1018.6875
7	1.75	1.875	0.170625	-1.40625	-0.14978492	89.3125	257.6875	89.3125	1016.5625	91.0625	257.5	91.3125	1019.5625
8	2	1.6875	0.1535625	-1.625	-0.11959643	89.6875	256.75	88.9375	1018.5625	90.9375	257.75	91.0625	1019.8125
9	2.25	1.8125	0.1649375	-2.3125	-0.24565594	89.4375	254.875	88.8125	1016.6875	91.0625	256.5	90.8125	1019.6875
10	2.5	1.75	0.15925	-6.5	-0.69043538	89.5625	250.375	89.0625	1012.5625	91.0625	256.5	91.0625	1019.4375
11	2.75	2.0625	0.1876875	-7.9375	-0.84375005	88.9375	248.75	89.4375	1010.5625	91.3125	256.5	91.1875	1018.6875
12	3	2	0.182	-8.375	-0.67815855	89.1875	248.5	88.9375	1010.5625	91.1875	255.5	90.9375	1016.3125



Ensayo 4

TEST1 - TORNILLO1

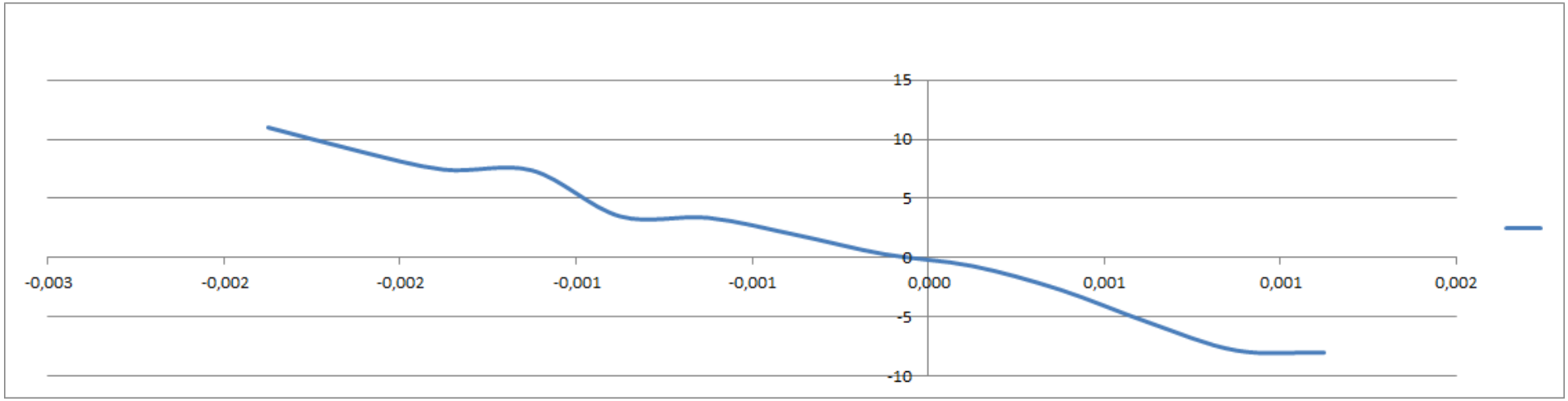
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_4	IncX	v	u	v	u	v	u	v	u
0	0.00	1.3125	0.1194375	11.03125	1.17276018	89.6875	272.6875	90.0625	1033.4375	91.1875	260.5	91.1875	1023.5625
1	0.25	1.4375	0.1308125	10.40625	1.21322231	89.5625	271.4375	89.4375	1032.4375	90.9375	259.5	90.9375	1021.5625
2	0.50	1.2822494	0.1166847	8.64968065	0.91994108	89.4355012	269.580611	89.375	1029.53125	90.4375	259.28125	90.9375	1022.53125
3	0.75	1.3125	0.1194375	6.25	0.66475432	89.8125	266.25	89.6875	1026.3125	91.0625	258.5	91.0625	1021.5625
4	1.00	1.3125	0.1194375	5.125	0.54545574	89.6875	264.625	89.6875	1024.5625	91.0625	258.375	90.9375	1020.5625
5	1.25	1.375	0.125125	4.4375	0.4713937	89.5625	262.5	89.4375	1024.4375	90.9375	257.5	90.8125	1020.5625
6	1.50	1.46975398	0.13374761	2.54057266	0.27097814	89.622992	258.643645	89.1875	1020.46875	90.59375	258.5	91.15625	1015.53125
7	1.75	1.75	0.15925	1.625	0.17285678	89.4375	259.46875	89.1875	1020.53125	90.9375	257.4375	91.1875	1019.3125
8	2	2.125	0.193375	-2.0625	-0.21924213	88.6875	255.5	88.9375	1017.4375	90.6875	257.5	91.1875	1019.5625
9	2.25	1.75	0.15925	-3	-0.31902902	88.9375	254.625	89.1875	1015.3125	90.8125	256.625	90.8125	1019.3125
10	2.5	1.75	0.15925	-4.4375	-0.47147089	89.8125	251.625	88.8125	1013.5625	91.0625	255.625	91.0625	1018.4375
11	2.75	1.8125	0.1649375	-6.625	-0.70464006	89.5625	250.5	89.0625	1010.4375	91.1875	255.5	91.0625	1018.6875
12	3	1.75	0.15925	-7.40625	-0.78666587	89.6875	248.5625	89.1875	1010.6875	91.3125	255.5	91.0625	1018.5625



Ensayo 5

TEST1 - TORNILLO1

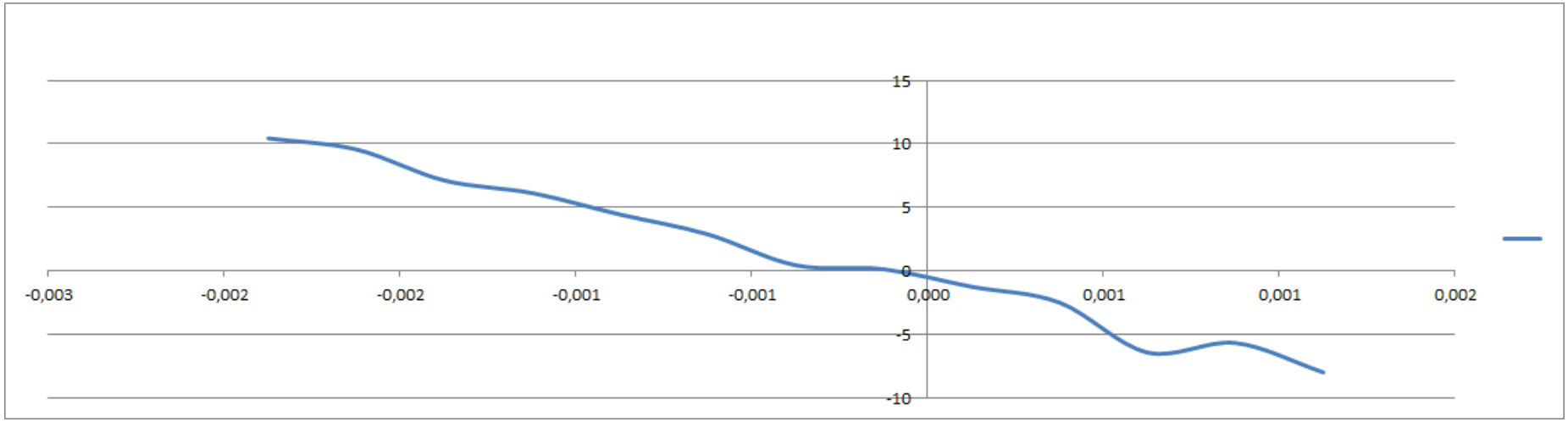
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_5	IncX	v	u	v	u	v	u	v	u
0	0.00	1.25	0.11375	11	1.16939433	89.5625	272.5	90.0625	1032.5625	90.9375	259.625	91.1875	1023.4375
1	0.25	1.4375	0.1308125	9.0625	0.96460438	89.4375	270.625	89.6875	1030.5625	90.6875	260.5	91.3125	1022.5625
2	0.50	0.9375	0.0853125	7.4375	0.79150992	89.5625	267.875	90.0625	1028.3125	90.5625	259.75	90.9375	1021.5625
3	0.75	1.5625	0.1421875	7.375	0.78556771	89.4375	266.625	89.6875	1027.4375	91.1875	259.625	91.0625	1019.6875
4	1.00	1.5625	0.1421875	3.5	0.37238467	89.4375	263.75	89.6875	1023.5625	91.0625	258.75	91.1875	1021.5625
5	1.25	1.0625	0.0966875	3.375	0.35896711	89.5625	262.375	89.9375	1022.5625	90.5625	257.625	91.0625	1020.5625
6	1.50	1.5625	0.1421875	1.9375	0.20602233	89.4375	259.75	89.3125	1021.3125	90.6875	257.625	91.1875	1019.5625
7	1.75	1.625	0.147875	0.3125	0.03325397	89.4375	258.5625	89.0625	1019.4375	90.9375	257.9375	90.8125	1019.4375
8	2	1.875	0.170625	-0.6875	-0.07312873	89.6875	256.25	89.0625	1018.3125	91.3125	257.5	91.1875	1018.4375
9	2.25	1.625	0.147875	-2.6875	-0.2858668	89.8125	254.375	89.0625	1016.3125	90.8125	257.5	91.3125	1018.5625
10	2.5	1.6875	0.1535625	-5.4375	-0.57762342	89.6875	250.5	89.1875	1013.6875	91.0625	256.625	91.1875	1018.4375
11	2.75	1.1875	0.1080625	-7.8125	-0.83046421	89.6875	248.625	89.5625	1009.5625	90.6875	255.375	90.9375	1018.4375
12	3	1.8125	0.1649375	-8	-0.85046492	89.4375	248.5	89.0625	1009.4375	91.0625	255.5	91.0625	1018.4375



Ensayo 6

TEST1 - TORNILLO1

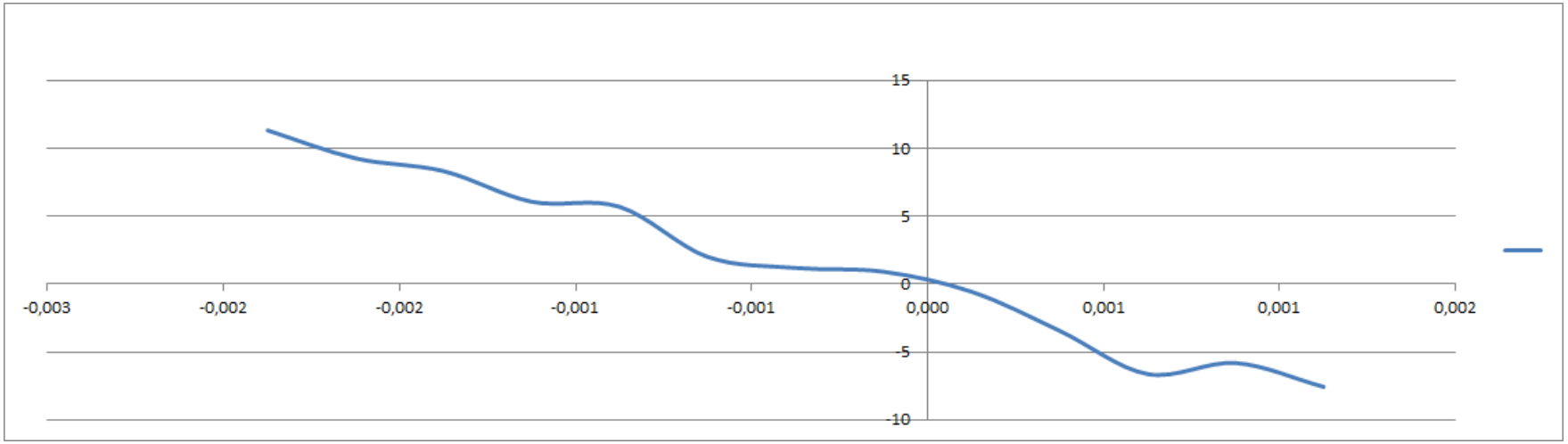
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_6	IncX	v	u	v	u	v	u	v	u
0	0.00	1.1875	0.1080625	10.4375	1.11041276	89.5625	272.5	90.1875	1032.4375	91.0625	260.625	91.0625	1023.4375
1	0.25	1.3125	0.1194375	9.5625	1.01882638	89.8125	270.625	89.4375	1030.4375	90.6875	260.625	91.1875	1021.3125
2	0.50	1.375	0.125125	7.125	0.75744501	89.6875	267.625	89.4375	1028.6875	90.9375	259.625	90.9375	1022.4375
3	0.75	1.75	0.15925	6.125	0.65039093	89.5625	266.125	89.0625	1027.6875	91.0625	258.75	91.0625	1022.8125
4	1.00	1.125	0.102375	4.4375	0.47185782	89.5625	264.5	89.4375	1025.6875	90.3125	259.5	90.9375	1021.8125
5	1.25	1.4375	0.1308125	2.875	0.30603749	89.8125	262.375	89.5625	1022.3125	91.3125	258.5	90.9375	1020.4375
6	1.50	1.5625	0.1421875	0.4375	0.04660577	89.5625	259.625	89.4375	1017.5625	91.0625	257.625	91.0625	1020.4375
7	1.75	1.8125	0.1649375	0.125	0.01330597	89.4375	258.625	89.3125	1018.6875	91.3125	257.625	91.0625	1019.4375
8	2	1.75	0.15925	-1.25	-0.13305956	89.3125	257.875	89.0625	1018.5625	90.8125	256.375	91.0625	1017.5625
9	2.25	1.6875	0.1535625	-2.5	-0.26590096	89.6875	254.375	89.0625	1016.6875	91.1875	257.625	90.9375	1018.4375
10	2.5	1.9375	0.1763125	-6.4375	-0.68497826	89.4375	251.75	88.9375	1011.4375	91.3125	256.625	90.9375	1019.4375
11	2.75	1.25	0.11375	-5.6875	-0.60547137	90.1875	251.625	88.9375	1011.6875	90.6875	256.5	90.9375	1018.1875
12	3	1.5	0.1365	-8	-0.85046492	89.9375	248.625	89.0625	1009.5625	90.8125	255.625	91.1875	1018.5625



Ensayo 7

TEST1 - TORNILLO1

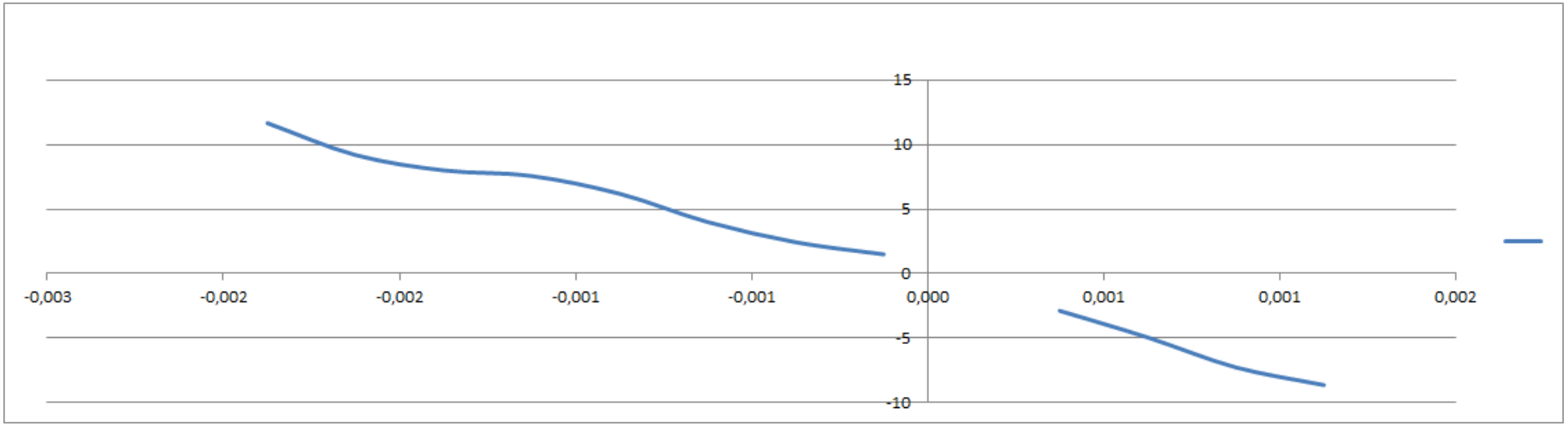
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_8	IncX	v	u	v	u	v	u	v	u
0	0.00	1.4375	0.1308125	11.3125	1.20468431	89.4375	272.375	89.9375	1032.4375	91.0625	260.5	91.1875	1021.6875
1	0.25	1.25	0.11375	9.25	0.98618137	89.375	270.875	89.625	1029.625	90.375	260.625	91.125	1021.375
2	0.50	1.625	0.147875	8.3125	0.88303308	89.6875	267.25	89.0625	1029.3125	90.9375	258.5	91.0625	1021.4375
3	0.75	1.5	0.1365	6.0625	0.64454888	89.4375	266.625	89.5625	1026.5625	91.0625	258.625	90.9375	1022.4375
4	1.00	1.375	0.125125	5.6875	0.60487465	89.5625	264.625	89.5625	1025.8125	90.6875	258.5	91.1875	1020.5625
5	1.25	1.5	0.1365	2	0.21293054	89.1875	261.625	88.9375	1021.5625	90.1875	258.75	90.9375	1020.4375
6	1.50	1.625	0.147875	1.1875	0.1199869	89.9375	259.625	89.1875	1018.1875	91.0625	258.5	91.3125	1019.6875
7	1.75	1.875	0.170625	0.90625	0.09631413	89.4375	258.4375	88.9375	1019.4375	90.9375	256.375	91.1875	1019.6875
8	2	1.75	0.15925	-0.5625	-0.05986214	89.8125	256.875	88.8125	1017.0625	90.9375	256.5	91.1875	1018.5625
9	2.25	1.625	0.147875	-3.4375	-0.36654977	89.3125	255.5	89.3125	1012.6875	91.0625	256.5	90.8125	1018.5625
10	2.5	1.875	0.170625	-6.625	-0.70463915	89.4375	251.375	88.9375	1011.5625	91.0625	256.625	91.0625	1019.5625
11	2.75	1.8125	0.1649375	-5.8125	-0.61867759	89.6875	251.625	88.8125	1011.4375	90.8125	256.25	91.3125	1018.4375
12	3	1.1875	0.1080625	-7.5625	-0.80349264	89.8125	247.625	89.0625	1010.4375	90.9375	255.625	90.3125	1017.5625



Ensayo 8

TEST1 - TORNILLO1

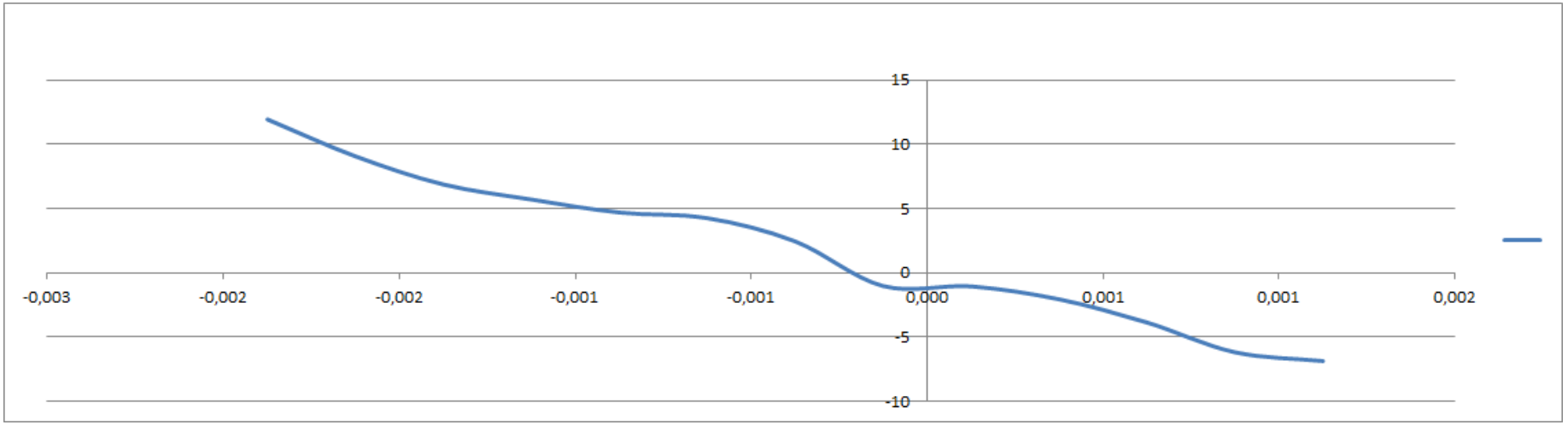
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_1	IncZ	IncU_9	IncX	v	u	v	u	v	u	v	u
0	0.00	0.8125	0.0739375	11.65625	1.23991556	89.9375	272.75	90.3125	1033.5625	90.6875	260.4375	91.1875	1022.5625
1	0.25	1.1875	0.1080625	9.1875	0.97694691	89.9375	270	89.5625	1030.5625	90.9375	259.625	90.9375	1022.5625
2	0.50	1.4375	0.1308125	8	0.85270761	89.5625	269.5	89.5625	1027.4375	90.9375	259.5	91.0625	1021.4375
3	0.75	2.0625	0.1876875	7.5625	0.80441607	88.8125	266.5	89.3125	1027.4375	91.1875	258.375	91.0625	1020.4375
4	1.00	1.5625	0.1421875	6.1875	0.65761854	89.5625	264.5	89.1875	1026.8125	91.0625	258.5	90.8125	1020.4375
5	1.25	2	0.182	4	0.42579129	89.4375	262.5	88.9375	1022.4375	91.1875	257.5	91.1875	1019.4375
6	1.50	1	0.091	2.4375	0.25995735	89.6875	260.5	90.0625	1019.4375	90.8125	257.5	90.9375	1017.5625
7	1.75	1.8125	0.1649375	1.5	0.15959288	89.3125	258.625	88.9375	1020.4375	90.9375	257.625	90.9375	1018.4375
8	2												
9	2.25	1.75	0.15925	-2.875	-0.30573569	89.6875	254.125	88.9375	1015.4375	90.9375	256.625	91.1875	1018.6875
10	2.5	1.9375	0.1763125	-4.9375	-0.52485296	89.0625	252.5	89.0625	1013.6875	90.9375	256.625	91.0625	1019.4375
11	2.75	1.75	0.15925	-7.25	-0.7704797	89.6875	249.375	88.9375	1011.5625	91.0625	256.625	91.0625	1018.8125
12	3	1.625	0.147875	-8.625	-0.91765927	89.5625	248.625	89.0625	1009.3125	90.8125	256.625	91.0625	1018.5625



Ensayo 9

TEST1 - TORNILLO1

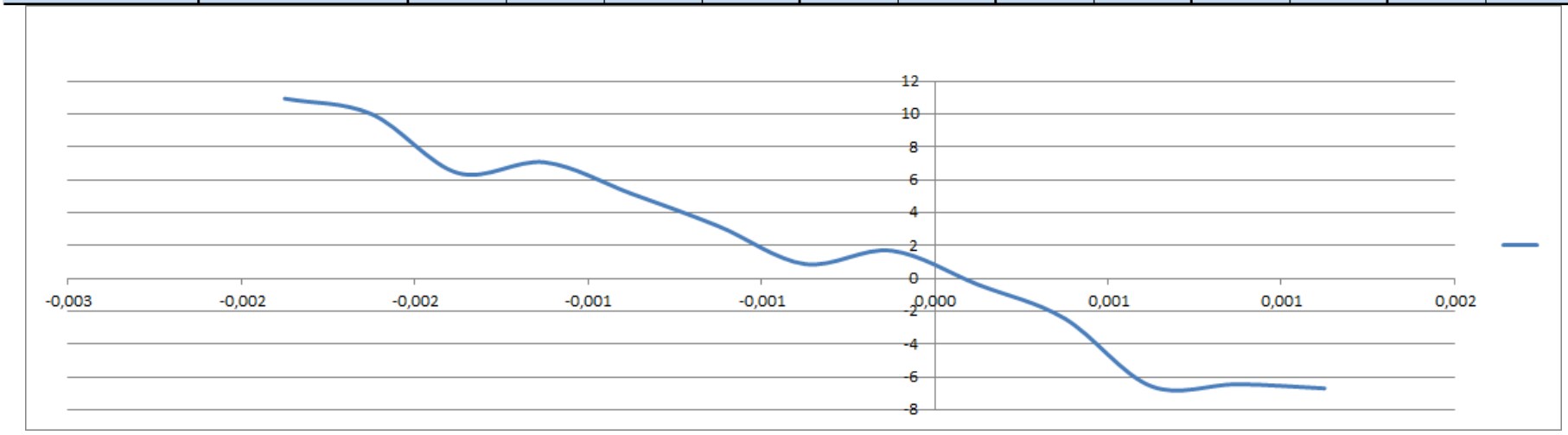
Posiciones tornillo	Rotación del tornillo					puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_10	IncX	v	u	v	u	v	u	v	u
0	0.00	1.1875	0.1080625	11.9375	1.26915505	89.5625	272.625	90.0625	1034.4375	91.0625	260.625	90.9375	1022.5625
1	0.25	1.625	0.147875	9.0625	0.96476384	89.6875	270.75	89.0625	1030.3125	91.1875	260.375	90.8125	1022.5625
2	0.50	1.375	0.125125	6.875	0.73158842	89.6875	267.375	89.5625	1027.5625	90.9375	259.5	91.0625	1021.6875
3	0.75	1.375	0.125125	5.7	0.59783565	89.6875	267.5	89.3125	1027.5625	90.8125	258.625	90.9375	1021.4375
4	1.00	1.75	0.15925	4.6875	0.4986065	89.4375	264.75	89.1875	1024.8125	91.0625	258.625	91.0625	1021.5625
5	1.25	1.9375	0.1763125	4.25	0.45158656	89.3125	262.375	89.0625	1024.3125	91.1875	257.75	91.0625	1020.4375
6	1.50	1.9375	0.1763125	2.4375	0.25965916	89.4375	261.5	88.9375	1020.3125	91.1875	257.5	91.0625	1019.4375
7	1.75	2.0625	0.1876875	-1.03125	-0.10976089	89.5625	257.625	88.8125	1017.4375	91.3125	257.4375	91.1875	1019.6875
8	2	1.75	0.15925	-1.0625	-0.11290587	89.6875	256.375	88.9375	1018.6875	90.9375	257.5	91.1875	1019.6875
9	2.25	2.0625	0.1876875	-2.0625	-0.21933241	89.0625	253.6875	89.3125	1016.3125	91.1875	256.6875	91.3125	1017.4375
10	2.5	2.125	0.193375	-3.875	-0.41194395	88.9375	251.5	88.9375	1014.4375	90.9375	256.375	91.1875	1017.3125
11	2.75	2.125	0.193375	-6.1875	-0.65772638	89.0625	250.375	88.8125	1012.3125	90.9375	256.5	91.1875	1018.5625
12	3	2.0625	0.1876875	-6.875	-0.73008852	89.3125	248.5625	88.9375	1011.4375	91.3125	255.5625	91.0625	1018.1875



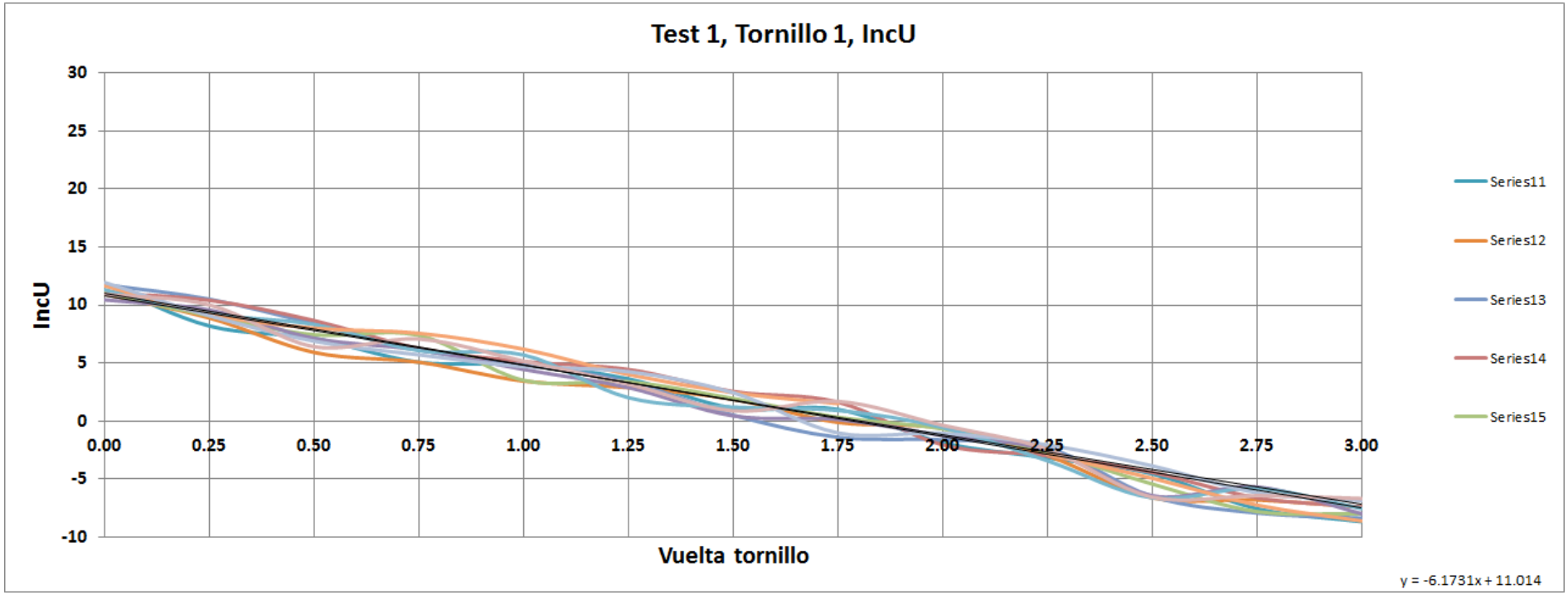
Ensayo 10

TEST1 - TORNILLO1

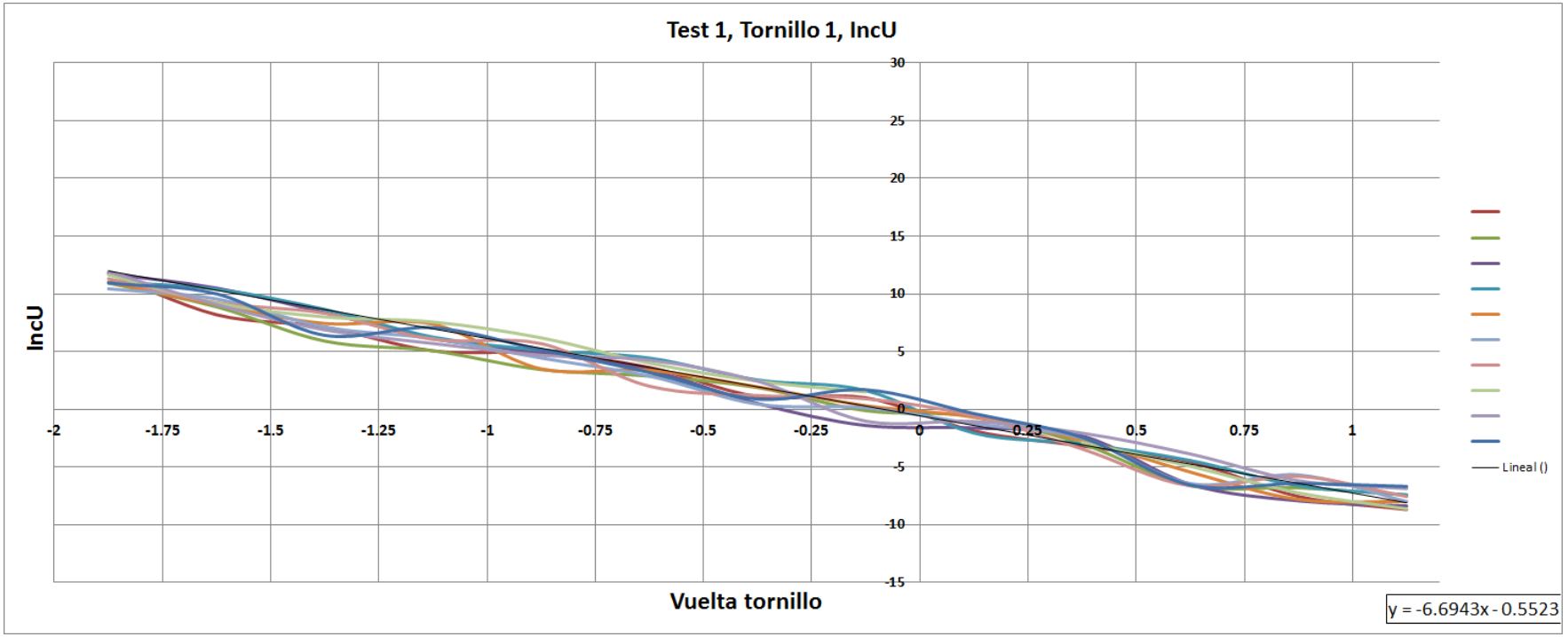
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_1	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	1.1875	0.1080625	10.9375	1.16446989	89.4375	273.5625	89.8125	1032.4375	90.8125	260.6875	90.8125	1023.4375
1	0.25	1.625	0.147875	10	1.06134044	89.3125	270.625	89.4375	1032.6875	90.9375	259.5	91.0625	1023.8125
2	0.50	1.25	0.11375	6.40625	0.68240894	89.8125	268.4375	89.6875	1027.4375	90.8125	260.625	91.1875	1022.4375
3	0.75	1.5	0.1365	7.0625	0.75271468	89.6875	267.375	89.4375	1026.5625	91.0625	259.5	91.0625	1020.3125
4	1.00	1.6875	0.1535625	5.15625	0.5479945	89.6875	264.8125	89.0625	1025.6875	91.1875	258.375	90.9375	1021.8125
5	1.25	1.1875	0.1080625	3.1875	0.33952596	89.4375	263.3125	90.1875	1022.4375	90.8125	258.8125	91.1875	1020.5625
6	1.50	1.75	0.15925	0.875	0.09315719	89.5625	259.625	89.3125	1019.3125	91.1875	257.625	91.1875	1019.5625
7	1.75	1.75	0.15925	1.6875	0.1794683	89.5625	259.625	88.9375	1020.8125	91.1875	257.5	90.8125	1019.5625
8	2	1.8125	0.1649375	-0.375	-0.03995069	89.4375	257.625	88.8125	1017.5625	90.9375	257.625	90.9375	1018.3125
9	2.25	1.875	0.170625	-2.4375	-0.2592746	89.5625	254.5	89.0625	1015.4375	91.1875	256.375	91.1875	1018.4375
10	2.5	1.75	0.15925	-6.5625	-0.69896745	89.5625	251.625	88.9375	1010.5625	90.9375	256.625	91.0625	1018.6875
11	2.75	1.8125	0.1649375	-6.4375	-0.68407712	89.4375	249.75	89.1875	1011.4375	90.9375	255.625	91.3125	1018.4375
12	3	1.9375	0.1763125	-6.6875	-0.71134313	89.4375	248.375	89.0625	1010.4375	91.1875	255.625	91.1875	1016.5625



Incremento de U relativo



Incremento de U absoluto

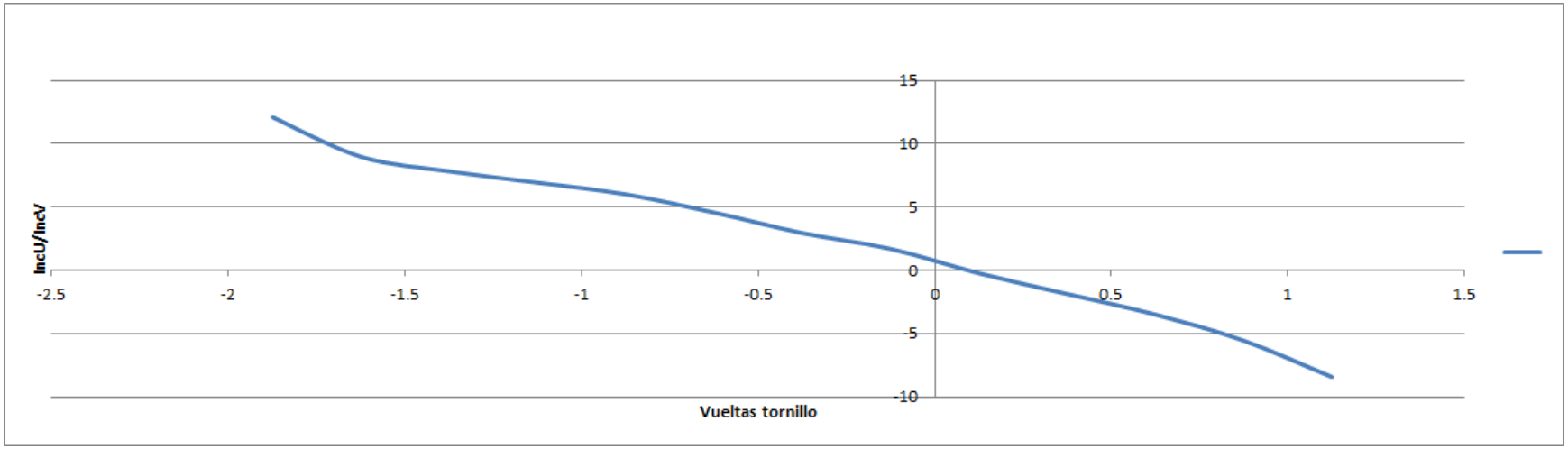


1.2. Ensayo Rotación Z, Tornillo2

Ensayo 1

TEST2 - TORNILLO2

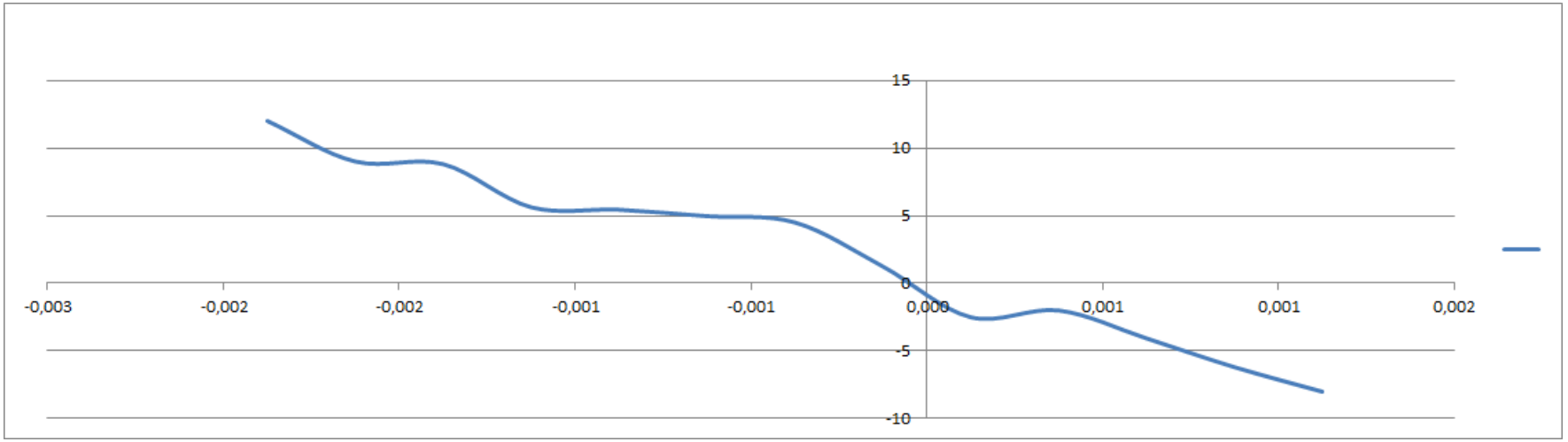
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	1.125	0.102375	12.09375	1.28729875	89.9375	272.9375	89.9375	1033.4375	90.9375	260.375	91.1875	1021.8125
1	0.25	1.125	0.102375	8.96875	0.95608465	89.6875	273.6875	90.1875	1031.3125	91.0625	262.5	91.0625	1024.5625
2	0.50	1.375	0.125125	7.8125	0.83155927	89.5625	273.375	89.9375	1032.4375	91.0625	263.625	91.1875	1026.5625
3	0.75	1.40625	0.12796875	6.921875	0.73589549	89.46875	273.5625	89.90625	1035.40625	91.15625	266.59375	91.03125	1028.53125
4	1.00	1.5	0.1365	6	0.63879077	89.6875	274.625	89.5625	1035.4375	91.1875	268.625	91.0625	1029.4375
5	1.25	1.1875	0.1080625	4.5625	0.48522911	89.6875	274.5	90.0625	1036.5625	90.9375	270.375	91.1875	1031.5625
6	1.50	1.5	0.1365	2.9375	0.31276762	89.5625	274.5	89.4375	1036.3125	91.0625	272.625	90.9375	1032.3125
7	1.75	1.4375	0.1308125	1.6875	0.17973461	89.5625	276.75	89.6875	1035.5625	90.9375	273.375	91.1875	1035.5625
8	2	1.625	0.147875	-0.2375	-0.02529804	89.3125	275.75	89.5625	1034.6875	91.0625	276.625	91.0625	1038.5625
9	2.25	1.5625	0.1421875	-1.875	-0.19958967	89.4375	276.625	89.4375	1036.5625	90.9375	277.5	91.0625	1039.4375
10	2.5	1.5625	0.1421875	-3.5	-0.37235281	89.6875	275.6875	89.3125	1037.5625	91.1875	279.6875	90.9375	1040.5625
11	2.75	1.6875	0.1535625	-5.5625	-0.59235836	89.3125	277.375	89.4375	1037.6875	91.0625	282.625	91.0625	1043.5625
12	3	1.4375	0.1308125	-8.4375	-0.89763635	89.8125	276.75	89.1875	1037.5625	90.9375	284.625	90.9375	1046.5625



Ensayo 2

TEST2 - TORNILLO2

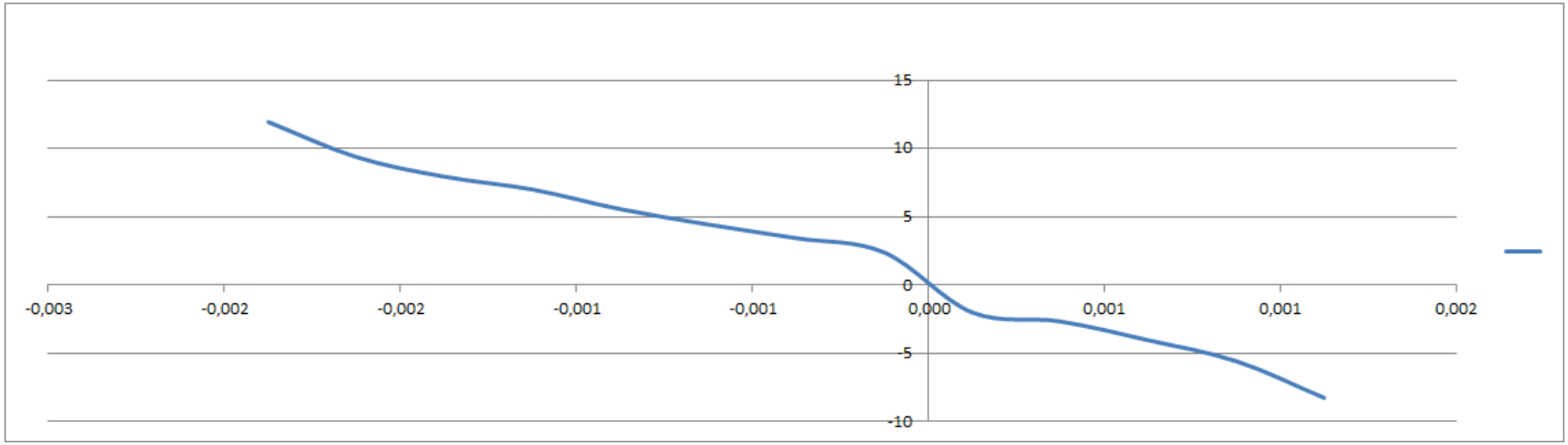
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	1.25	0.11375	12	1.27381717	89.6875	272.625	90.0625	1034.5625	91.0625	259.5	91.1875	1023.6875
1	0.25	1.125	0.102375	9	0.95787721	89.5625	273.5	90.0625	1032.6875	91.0625	262.625	90.8125	1025.5625
2	0.50	1.1875	0.1080625	8.8125	0.93630562	90.0625	273.875	89.8125	1034.5625	91.0625	263.375	91.1875	1027.4375
3	0.75	1.4375	0.1308125	5.625	0.59906593	89.3125	273.75	89.9375	1032.6875	91.1875	266.5	90.9375	1028.6875
4	1.00	1.125	0.102375	5.4375	0.57838158	89.9375	273.625	89.9375	1035.4375	91.3125	268.5	90.8125	1029.6875
5	1.25	1.125	0.102375	4.96875	0.52880312	89.5625	275.4375	90.1875	1036.5625	90.9375	270.5	91.0625	1031.5625
6	1.50	1.5	0.1365	4.5	0.47940835	89.4375	275.625	89.4375	1036.4375	90.9375	271.625	90.9375	1031.4375
7	1.75	1.375	0.125125	1.25	0.13321334	89.6875	276.625	89.5625	1035.0625	90.9375	273.75	91.0625	1035.4375
8	2	1.375	0.125125	-2.5	-0.26625118	89.4375	275.5	90.0625	1034.6875	91.0625	276.625	91.1875	1038.5625
9	2.25	1.4375	0.1308125	-2	-0.21317543	89.4375	276.75	89.9375	1036.5625	91.3125	278.625	90.9375	1038.6875
10	2.5	1.375	0.125125	-4.0625	-0.43247955	89.4375	275.625	89.8125	1037.3125	91.1875	280.5	90.8125	1040.5625
11	2.75	0.125	0.011375	-6.1875	0.01996057	90.9375	282.625	90.9375	1043.5625	90.9375	282.5	91.1875	1043.3125
12	3	0.875	0.079625	-8	-0.85046355	90.1875	276.375	90.0625	1038.5625	91.1875	284.625	90.8125	1046.3125



Ensayo 3

TEST2 - TORNILLO2

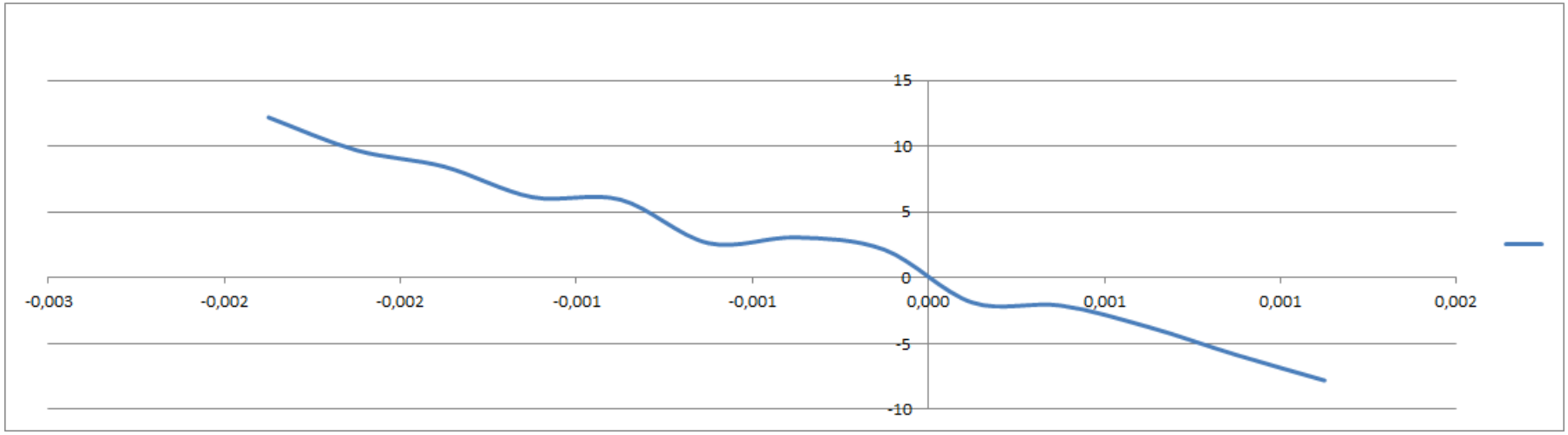
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_3	IncX	v	u	v	u	v	u	v	u
0	0.00	0.9375	0.0853125	11.9375	1.26770157	90.1875	272.625	90.0625	1034.3125	90.9375	259.625	91.1875	1023.4375
1	0.25	1.1875	0.1080625	9.375	0.99598395	90.0625	272.625	89.9375	1034.4375	91.1875	262.625	91.1875	1025.6875
2	0.50	1.1875	0.1080625	7.9375	0.84375477	89.4375	273.375	90.0625	1033.5625	90.9375	263.625	90.9375	1027.4375
3	0.75	1.375	0.125125	7	0.74685107	89.0625	273.5	90.0625	1032.6875	90.9375	266.5	90.9375	1025.6875
4	1.00	1.1875	0.1080625	5.5625	0.59265054	89.5625	274.875	90.0625	1035.4375	91.0625	269.625	90.9375	1029.5625
5	1.25	1.1875	0.1080625	4.4375	0.47216775	89.6875	274.625	90.0625	1036.4375	91.0625	270.75	91.0625	1031.4375
6	1.50	1.3125	0.1194375	3.4375	0.36618465	89.3125	275.5	90.0625	1035.3125	90.9375	271.5	91.0625	1032.4375
7	1.75	1.31451396	0.11962077	2.39272898	0.25487447	89.7459721	277.410458	90	1036.5625	91.0625	273.75	91.3125	1035.4375
8	2	1.25	0.11375	-2	-0.21265121	89.6875	274.75	90.0625	1035.4375	91.1875	275.625	91.0625	1038.5625
9	2.25	1.3125	0.1194375	-2.65625	-0.28255533	89.5625	276.5625	89.9375	1036.5625	90.9375	277.75	91.1875	1040.6875
10	2.5	1	0.091	-4.03125	-0.42902898	89.9375	275.5625	89.8125	1036.4375	90.9375	279.375	90.8125	1040.6875
11	2.75	1.8125	0.1649375	-5.5625	-0.59323588	89.4375	277.5	89.3125	1036.5625	91.1875	282.625	91.1875	1042.5625
12	3	1.625	0.147875	-8.25	-0.87833882	89.9375	277.375	89.0625	1037.1875	91.0625	284.625	91.1875	1046.4375



Ensayo 4

TEST2 - TORNILLO2

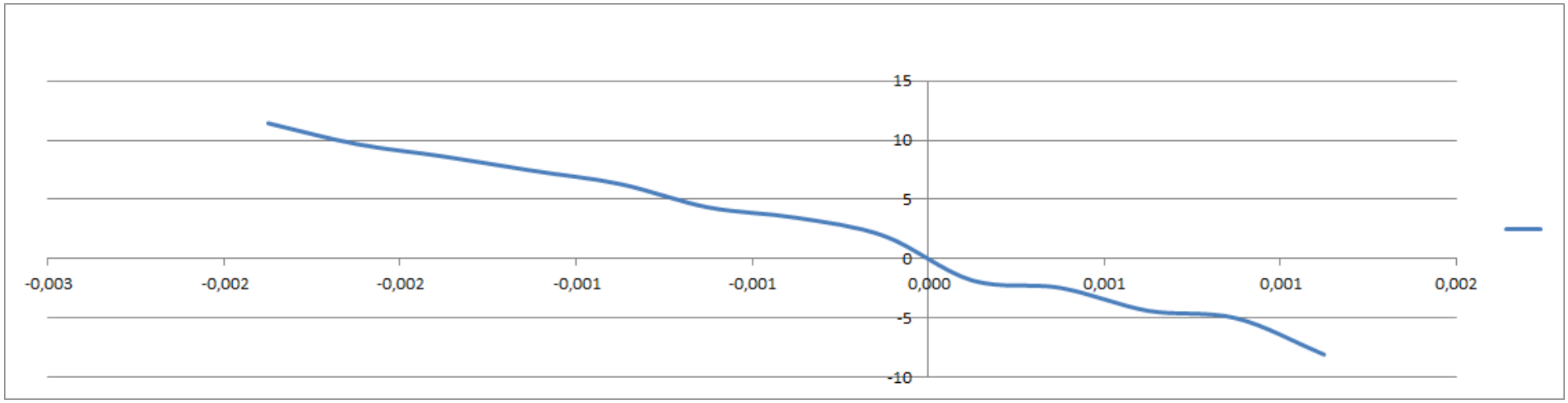
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_4	IncX	v	u	v	u	v	u	v	u
0	0.00	0.9375	0.0853125	12.1875	1.29382623	90.1875	272.625	89.8125	1034.5625	90.8125	259.375	91.0625	1023.4375
1	0.25	0.9375	0.0853125	9.6875	1.02909892	89.9375	272.75	90.1875	1034.6875	91.0625	262.5	90.9375	1025.5625
2	0.50	1	0.091	8.4375	0.89543121	90.0625	272.75	89.9375	1035.4375	91.0625	263.75	90.9375	1027.5625
3	0.75	1.1875	0.1080625	6.125	0.6527435	89.5625	273.5	89.8125	1032.5625	90.8125	266.375	90.9375	1027.4375
4	1.00	1.4375	0.1308125	5.9375	0.63187719	89.4375	274.25	90.0625	1035.5625	91.3125	268.5	91.0625	1029.4375
5	1.25	0.9375	0.0853125	2.625	0.27901316	90.0625	273.25	90.1875	1036.4375	91.1875	271.75	90.9375	1032.6875
6	1.50	1.3125	0.1194375	3.0625	0.32596917	89.6875	274.5	90.1875	1035.8125	91.3125	271.75	91.1875	1032.4375
7	1.75	1.25	0.11375	2.125	0.22623901	89.5625	277	90.0625	1036.5625	90.9375	273.625	91.1875	1035.6875
8	2	1.15625	0.10521875	-1.890625	-0.20123222	89.5625	275.625	90.1875	1035.6875	91.03125	276.5625	91.03125	1038.53125
9	2.25	1.09375	0.09953125	-2.109375	-0.22459837	89.8125	276.625	90.1875	1036.3125	91.09375	277.6875	91.09375	1039.46875
10	2.5	0.9375	0.0853125	-3.75	-0.39924492	90.0625	275.875	90.0625	1037.6875	91.0625	280.625	90.9375	1040.4375
11	2.75	0.625	0.056875	-5.875	-0.62548263	90.1875	276.75	90.1875	1037.5625	90.9375	282.625	90.6875	1043.4375
12	3	1.125	0.102375	-7.8125	-0.83087163	89.4375	277.25	90.1875	1038.5625	90.9375	284.75	90.9375	1046.6875



Ensayo 5

TEST2 - TORNILLO2

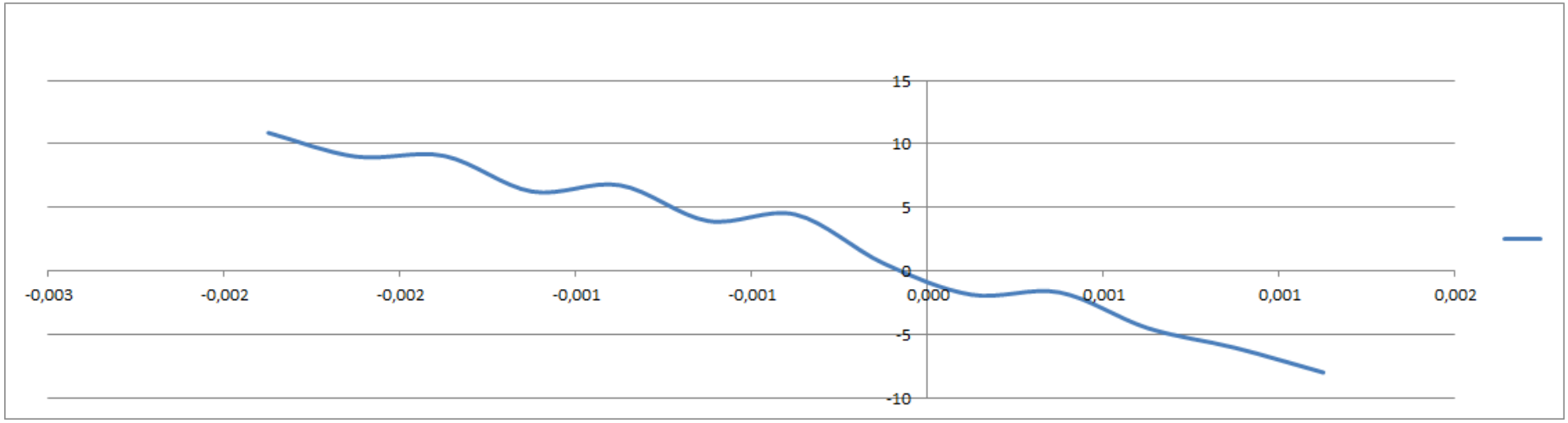
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_5	IncX	v	u	v	u	v	u	v	u
0	0.00	1	0.091	11.4375	1.21360832	90.1875	271.75	90.0625	1034.4375	90.9375	259.625	91.3125	1023.6875
1	0.25	1.125	0.102375	9.6875	1.0290992	89.9375	272.875	89.9375	1034.6875	91.0625	262.5	91.0625	1025.6875
2	0.50	0.8125	0.0739375	8.625	0.91570656	90.0625	273.125	90.1875	1034.8125	90.9375	263.25	90.9375	1027.4375
3	0.75	1.1875	0.1080625	7.4375	0.79424917	89.6875	273.375	89.9375	1032.5625	90.9375	266.625	91.0625	1024.4375
4	1.00	1.3125	0.1194375	6.3125	0.67189554	89.9375	274.75	89.9375	1035.6875	91.3125	268.375	91.1875	1029.4375
5	1.25	1.1875	0.1080625	4.34375	0.46213527	89.6875	274.8125	89.9375	1036.4375	91.0625	270.75	90.9375	1031.8125
6	1.50	1	0.091	3.46875	0.36907362	90.0625	274.625	90.0625	1036.3125	91.0625	271.5625	91.0625	1032.4375
7	1.75	1.25	0.11375	1.9375	0.20625955	89.9375	276.625	89.9375	1036.5625	91.1875	273.75	91.1875	1035.5625
8	2	1.0625	0.0966875	-1.8125	-0.19295257	90.0625	275.75	90.1875	1035.5625	91.0625	276.5	91.3125	1038.4375
9	2.25	1.125	0.102375	-2.4375	-0.25957281	89.8125	276.5	89.9375	1036.6875	90.8125	278.5	91.1875	1039.5625
10	2.5	0.875	0.079625	-4.375	-0.46605305	90.1875	275.6875	89.9375	1036.4375	91.1875	280.4375	90.6875	1040.4375
11	2.75	1.125	0.102375	-5	-0.53215079	89.5625	277.5	90.1875	1038.6875	90.9375	282.625	91.0625	1043.5625
12	3	1.0625	0.0966875	-8.0625	-0.85844562	90.0625	276.625	89.9375	1037.3125	91.0625	284.625	91.0625	1045.4375



Ensayo 6

TEST2 - TORNILLO2

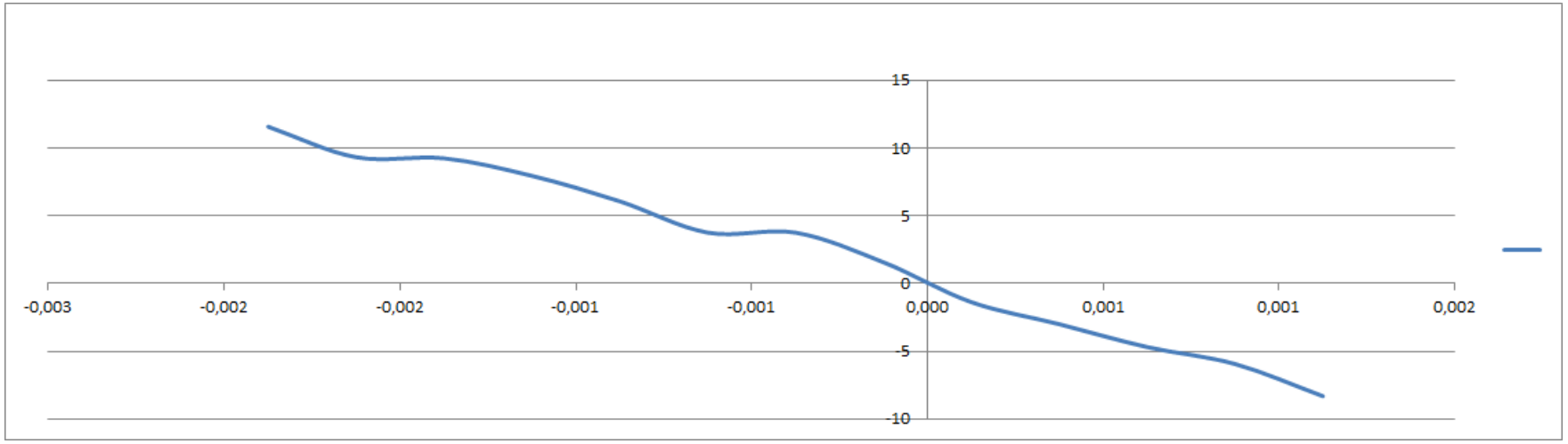
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_6	IncX	v	u	v	u	v	u	v	u
0	0.00	1.0625	0.0966875	10.875	1.15458347	90.0625	271.5	90.1875	1034.3125	91.3125	260.5	91.0625	1023.5625
1	0.25	0.6875	0.0625625	9	0.95692931	90.3125	272.625	90.1875	1033.6875	90.9375	262.875	90.9375	1025.4375
2	0.50	0.9375	0.0853125	9.0625	0.96349654	90.0625	273.625	90.3125	1034.4375	91.0625	263.5	91.1875	1026.4375
3	0.75	1.3125	0.1194375	6.25	0.6654356	89.125	273.875	90.375	1033.625	91	266.59375	91.125	1028.40625
4	1.00	1.0625	0.0966875	6.75	0.71946755	90.0625	274.875	89.8125	1035.4375	90.9375	268.75	91.0625	1028.0625
5	1.25	1.25	0.11375	3.9375	0.41917203	89.4375	274.75	89.8125	1035.4375	91.1875	270.625	90.5625	1031.6875
6	1.50	1.3125	0.1194375	4.4375	0.47263482	89.6875	274.5	89.6875	1036.4375	91.0625	271.5	90.9375	1030.5625
7	1.75	0.96976313	0.08824845	0.58703265	0.06253395	89.9979737	275.642815	90.1875	1035.46875	91.3125	274.5	90.8125	1035.4375
8	2	0.8125	0.0739375	-1.875	-0.19958933	90.0625	274.625	90.1875	1035.6875	91.3125	276.625	90.5625	1037.4375
9	2.25	0.9375	0.0853125	-1.6875	-0.17973383	89.8125	276.5	89.9375	1036.4375	90.9375	277.625	90.6875	1038.6875
10	2.5	0.875	0.079625	-4.5	-0.47932966	89.9375	275.5	89.8125	1036.5625	91.1875	280.625	90.3125	1040.4375
11	2.75	0.625	0.056875	-6.0625	-0.64528679	89.9375	277.5	90.3125	1037.5625	91.1875	282.625	90.3125	1044.5625
12	3	0.625	0.056875	-8	-0.851861	90.0625	277.75	89.6875	1038.3125	90.9375	285.625	90.0625	1046.4375



Ensayo 7

TEST2 - TORNILLO2

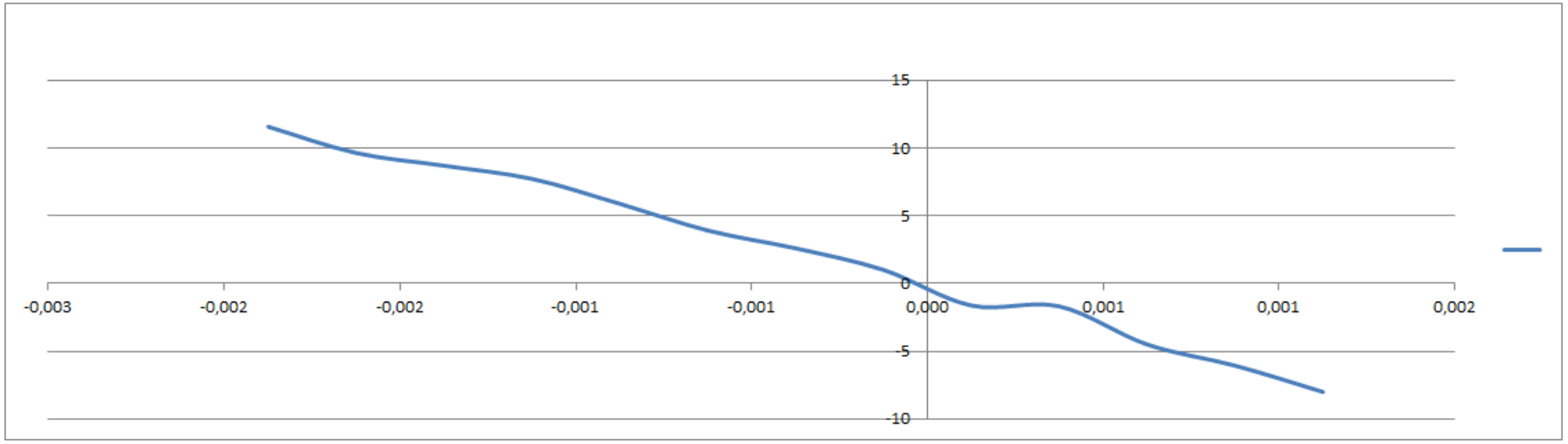
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_8	IncX	v	u	v	u	v	u	v	u
0	0.00	1.0625	0.0966875	11.5625	1.22687147	90.0625	271.5	90.1875	1034.3125	91.3125	259.375	91.0625	1023.3125
1	0.25	1.3125	0.1194375	9.3125	0.9905638	89.5625	273.125	90.0625	1033.4375	91.1875	262.625	91.0625	1025.3125
2	0.50	0.8125	0.0739375	9.234375	0.98166852	90.3125	273.625	90.1875	1034.6875	91.09375	263.5	91.03125	1026.34375
3	0.75	1.25	0.11375	7.9375	0.84694757	89.4375	273.25	90.0625	1033.5625	90.9375	266.5	91.0625	1024.4375
4	1.00	1.25	0.11375	6.0625	0.64459915	90.0625	273.5625	89.9375	1036.5625	91.1875	268.6875	91.3125	1029.3125
5	1.25	0.625	0.056875	3.75	0.39904764	90.0625	273.875	90.0625	1035.4375	90.9375	270.5	90.4375	1031.3125
6	1.50	0.6875	0.0625625	3.75	0.39931022	90.1875	274.5	90.0625	1035.9375	91.0625	271.5	90.5625	1031.4375
7	1.75	0.5625	0.0511875	1.5625	0.16617435	90.0625	275.5	90.4375	1036.6875	91.0625	273.5	90.5625	1035.5625
8	2	0.4375	0.0398125	-1.375	-0.14631762	90.1875	275	90.0625	1035.3125	91.0625	275.5	90.0625	1037.5625
9	2.25	0.75	0.06825	-3	-0.31971055	90.1875	275.5	90.0625	1035.5625	91.0625	278.5	90.6875	1038.5625
10	2.5	0.625	0.056875	-4.6875	-0.4986065	89.9375	274.5	90.0625	1037.4375	90.8125	280.625	90.4375	1040.6875
11	2.75	0.4375	0.0398125	-5.9375	-0.63208478	90.1875	276.625	90.3125	1037.4375	91.1875	282.5	90.1875	1043.4375
12	3	0.625	0.056875	-8.3125	-0.88564632	90.1875	277.5	89.6875	1037.4375	91.1875	285.5	89.9375	1046.0625



Ensayo 8

TEST2 - TORNILLO2

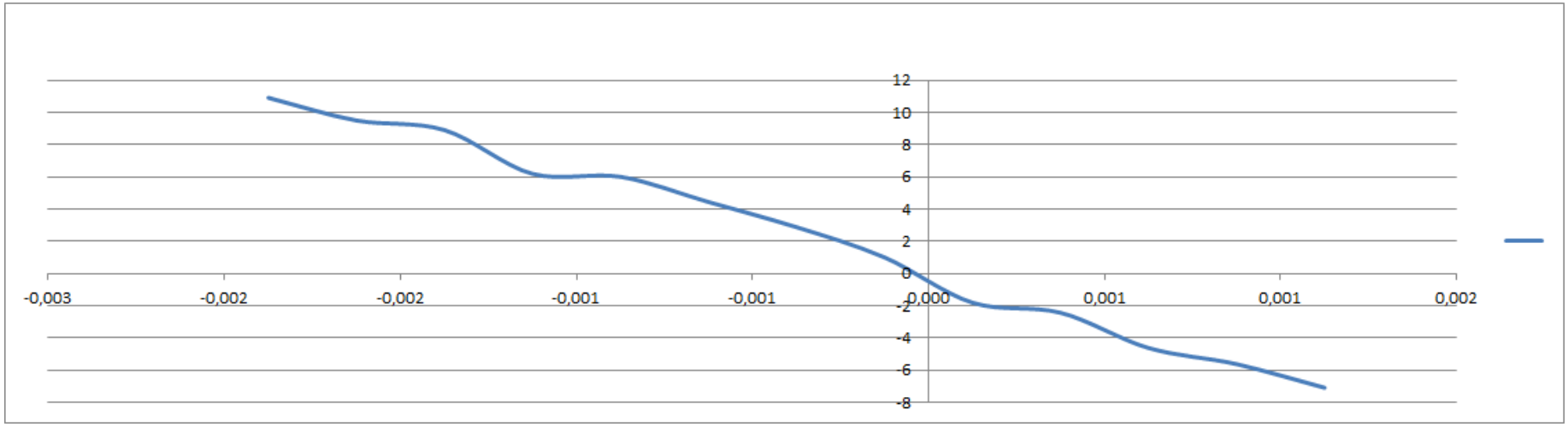
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_8	IncX	v	u	v	u	v	u	v	u
0	0.00	1.125	0.102375	11.5625	1.22687121	89.9375	271.625	89.9375	1034.5625	91.0625	259.625	91.0625	1023.4375
1	0.25	1.0625	0.0966875	9.625	1.0223759	90.1875	272.5	89.9375	1034.4375	91.0625	262.25	91.1875	1025.4375
2	0.50	0.9375	0.0853125	8.6875	0.92317293	90.3125	273	90.0625	1034.3125	91.1875	263.375	91.0625	1026.5625
3	0.75	0.75	0.06825	7.71875	0.82337004	89.8125	272.9375	90.0625	1033.6875	90.9375	266.625	90.4375	1024.5625
4	1.00	1.1875	0.1080625	5.875	0.62527799	90.1875	273.5	89.6875	1035.4375	91.1875	268.5	91.0625	1028.6875
5	1.25	0.75	0.06825	3.90625	0.415249	89.9375	273.5	89.9375	1036.4375	90.75	270.5625	90.625	1031.5625
6	1.50	0.3125	0.0284375	2.59375	0.27558934	90.1875	273.6875	90.1875	1036.4375	91.0625	271.5	89.9375	1033.4375
7	1.75	0.625	0.056875	1	0.10629049	90.1875	274.75	90.1875	1036.8125	91.0625	273.75	90.5625	1035.8125
8	2	0.3125	0.0284375	-1.625	-0.17302005	90.1875	274.8125	90.3125	1035.6875	91.0625	276.5625	90.0625	1037.1875
9	2.25	0.4375	0.0398125	-1.6875	-0.17961565	90.0625	275.75	89.9375	1036.5625	91.0625	277.25	89.8125	1038.4375
10	2.5	0.625	0.056875	-4.5	-0.47925309	90.1875	275.375	90.0625	1037.6875	91.1875	281.625	90.3125	1040.4375
11	2.75	0.125	0.011375	-6.0625	-0.64528654	90.4375	277.375	90.3125	1037.5625	91.0625	282.625	89.9375	1044.4375
12	3	0.5625	0.0511875	-8	-0.85144124	90.3125	277.625	89.6875	1038.6875	91.3125	285.625	89.8125	1046.6875



Ensayo 9

TEST2 - TORNILLO2

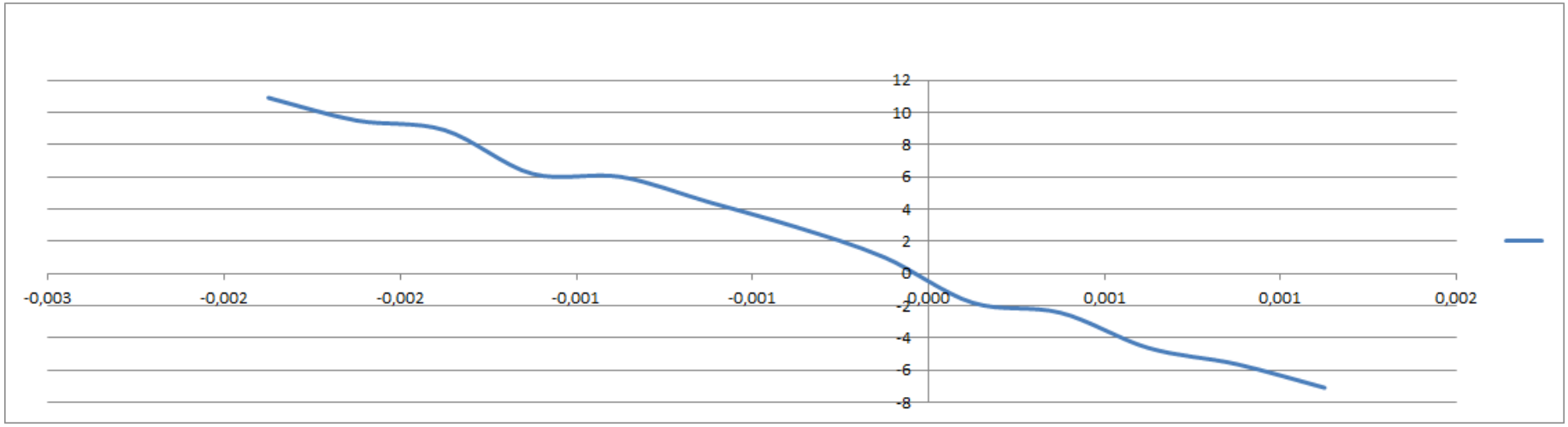
Posiciones tornillo	Rotación del tornillo					puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_10	IncX	v	u	v	u	v	u	v	u
0	0.00	1.0625	0.0966875	11.25	1.19361492	90.1875	271.625	89.9375	1034.5625	91.1875	259.875	91.0625	1023.8125
1	0.25	0.875	0.079625	9.25	0.98351102	90.0625	272.75	90.0625	1033.6875	90.6875	262.625	91.1875	1025.3125
2	0.50	1.125	0.102375	9.0625	0.9622317	89.9375	272.625	89.9375	1035.5625	90.9375	263.625	91.1875	1026.4375
3	0.75	1.1875	0.1080625	5.875	0.62599749	89.5625	273.125	90.0625	1032.5625	91.1875	266.5	90.8125	1027.4375
4	1.00	0.8125	0.0739375	5.8125	0.61862531	90.3125	274.3125	90.1875	1035.5625	91.0625	268.6875	91.0625	1029.5625
5	1.25	1.5	0.1365	5.0625	0.53902399	89.4375	275.625	90.1875	1036.3125	91.3125	270.5	91.3125	1031.3125
6	1.50	1.5	0.1365	4.125	0.43909652	89.3125	275.625	90.0625	1036.6875	91.0625	271.625	91.3125	1032.4375
7	1.75	1.25	0.11375	1.0625	0.11309206	89.5625	276.5	89.9375	1035.5625	91.0625	273.5	90.9375	1036.4375
8	2	0.75	0.06825	-0.875	-0.09314184	90.1875	276.625	90.1875	1036.5625	90.8125	276.5	91.0625	1038.4375
9	2.25	1.5	0.1365	-2	-0.21321107	89.5625	276.75	89.9375	1035.3125	91.3125	277.5	91.1875	1038.5625
10	2.5	1.3125	0.1194375	-4.96875	-0.52806702	89.5	274.5625	90.125	1037.8125	91.1875	280.625	91.0625	1041.6875
11	2.75	1.0625	0.0966875	-5.125	-0.54590309	89.5625	277.75	90.3125	1037.6875	90.9375	282.375	91.0625	1043.3125
12	3	1.0625	0.0966875	-6.8125	-0.72523411	89.5625	277.75	90.3125	1038.6875	91.1875	284.625	90.8125	1045.4375



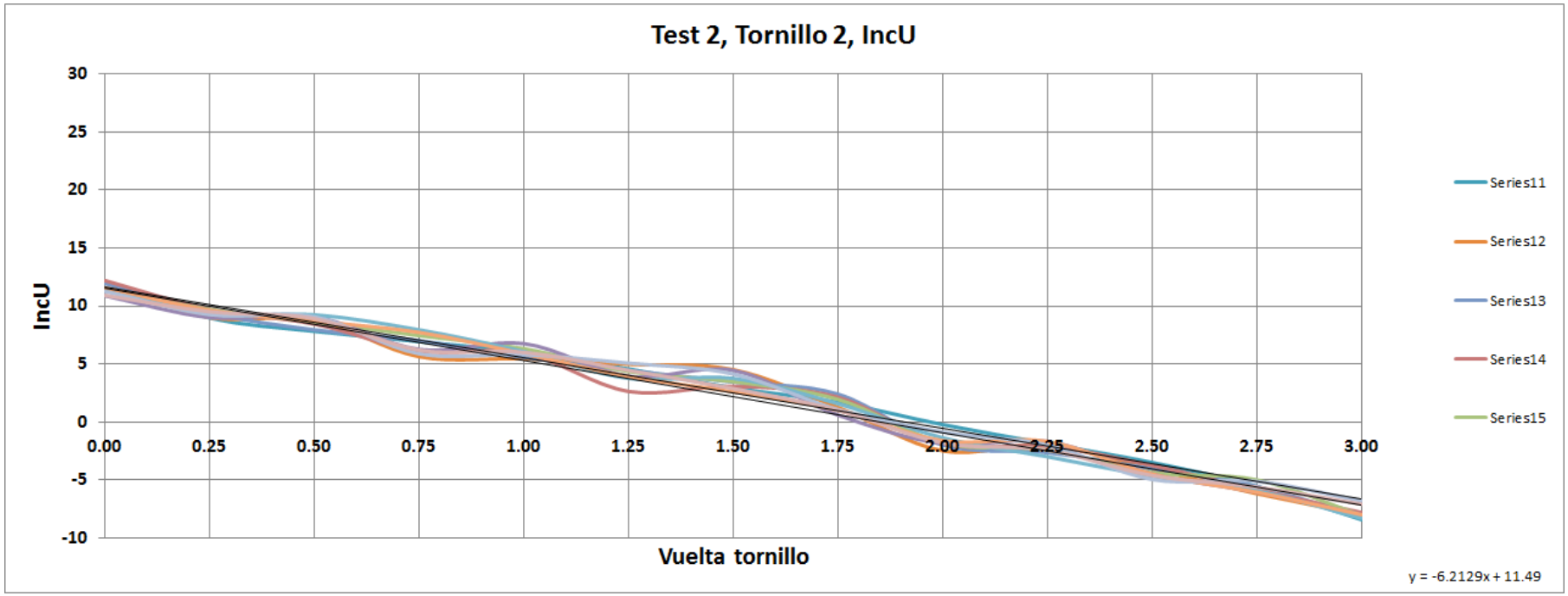
Ensayo 10

TEST2 - TORNILLO2

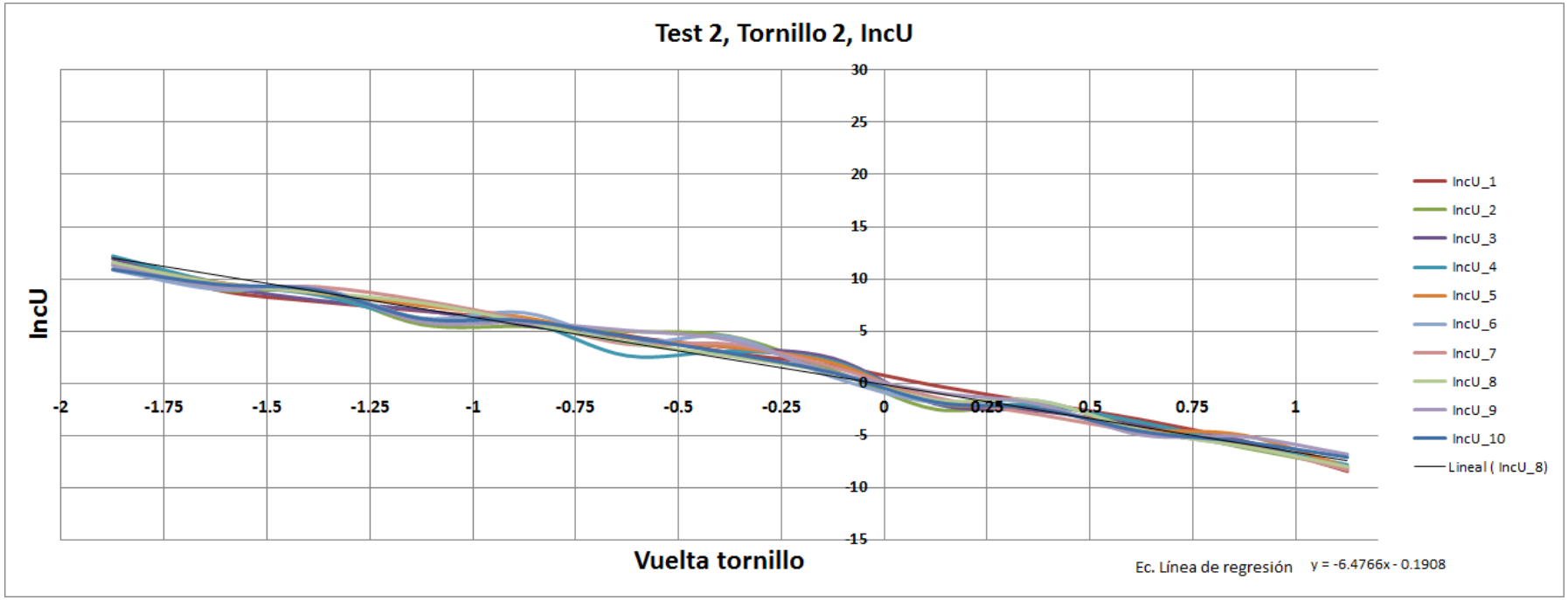
Posiciones tornillo	Rotación del tornillo					puntoA1		puntoB1		puntoA2		puntoB2	
		IncV	IncZ	IncU_10	IncX	v	u	v	u	v	u	v	u
0	0.00	1.1875	0.1080625	10.90625	1.15756932	89.9375	271.4375	90.0625	1034.6875	91.1875	260.625	91.1875	1023.6875
1	0.25	1	0.091	9.5	1.00909805	90.3125	272.5	90.0625	1034.5625	91.1875	262.5	91.1875	1025.5625
2	0.50	1.25	0.11375	8.90625	0.94560277	90.0625	272.5625	89.9375	1035.5625	91.1875	263.75	91.3125	1026.5625
3	0.75	1.25	0.11375	6.1875	0.65848379	89.6875	273.625	90.0625	1033.6875	91.3125	266.375	90.9375	1028.5625
4	1.00	1.0625	0.0966875	6	0.63800475	89.5625	273.9375	90.0625	1035.3125	90.9375	267.5625	90.8125	1029.6875
5	1.25	1.25	0.11375	4.4375	0.47193516	89.5625	274.5	89.9375	1036.5625	91.0625	270.5	90.9375	1031.6875
6	1.50	1.25	0.11375	2.875	0.30641451	89.6875	275.3125	89.9375	1035.5625	91.0625	272.6875	91.0625	1032.4375
7	1.75	1.4375	0.1308125	1	0.10644837	89.1875	276.5	90.0625	1035.4375	90.9375	273.5	91.1875	1036.4375
8	2	1.1875	0.1080625	-1.8125	-0.19282605	89.5625	275.375	90.0625	1035.4375	91.1875	275.875	90.8125	1038.5625
9	2.25	1.0625	0.0966875	-2.4375	-0.25957286	89.9375	276.5	90.1875	1036.5625	91.3125	278.375	90.9375	1039.5625
10	2.5	0.9375	0.0853125	-4.625	-0.49256499	90.1875	275.5	89.9375	1037.5625	90.9375	281.625	91.0625	1040.6875
11	2.75	1	0.091	-5.625	-0.59837493	90.1875	276.625	90.0625	1038.4375	91.1875	282.625	91.0625	1043.6875
12	3	0.9375	0.0853125	-7.09375	-0.75421469	89.9375	276.625	90.3125	1038.4375	90.9375	283.6875	91.1875	1045.5625



Incremento de U relativo



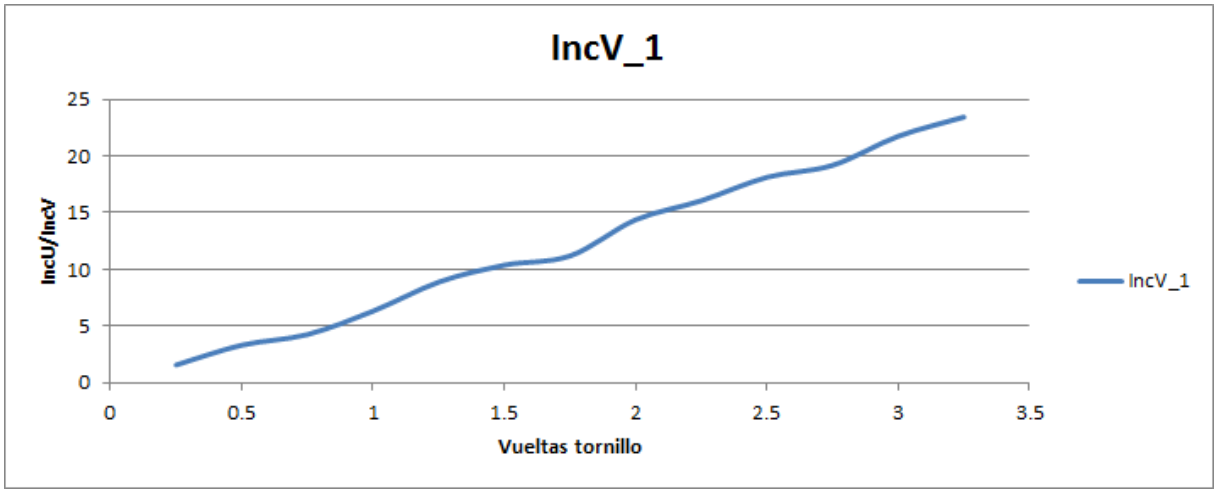
Incremento de U absoluto



1.3. Ensayo Rotación X, tornillos 3 y 4

Ensayo 1

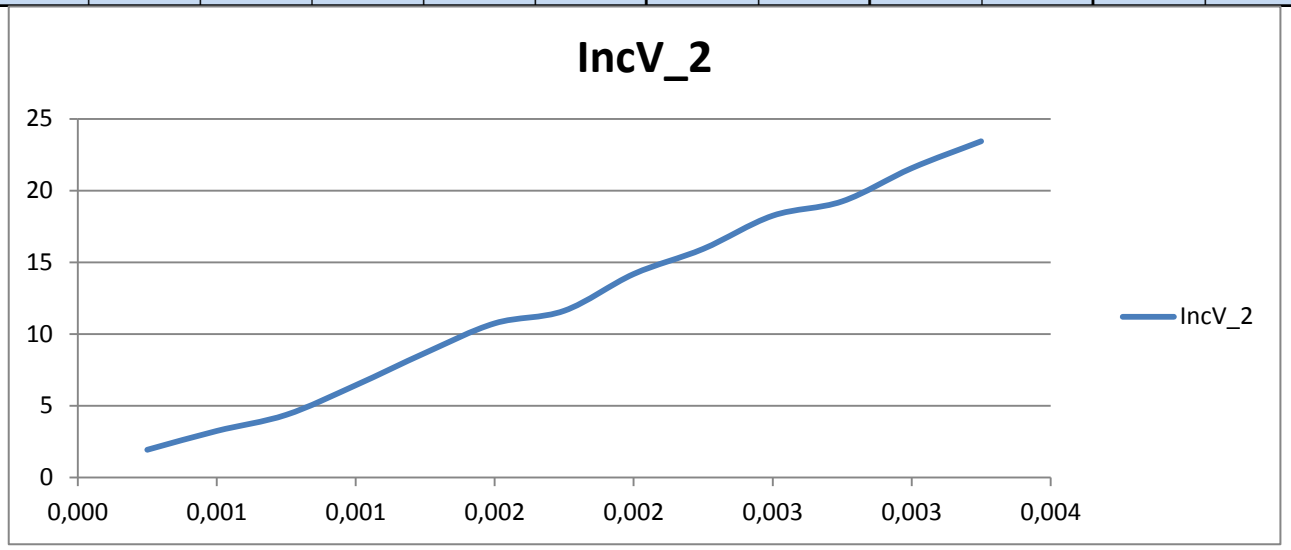
TEST3 - TORNILLO3-4													
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_1	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	1.5625	0.1421875	11.96875	1.27232098	88.8125	272.8125	88.8125	1034.5625	89.8125	260.625	90.9375	1022.8125
1	0.25	3.3125	0.3014375	11.59375	1.23510541	86.3125	273.6875	87.3125	1031.4375	90.0625	259.5	90.1875	1022.4375
2	0.50	4.25	0.38675	11.6875	1.24349538	85.1875	272.5625	86.0625	1034.6875	89.5625	261.6875	90.1875	1022.1875
3	0.75	6.31414169	0.57458689	11.2679792	1.19849403	82.1217166	272.285958	83.25	1033.4375	88.9375	260.625	89.0625	1022.5625
4	1.00	8.87655014	0.80776606	11.6429609	1.23655164	80.2468997	272.660922	80	1034.8125	88.9375	260.5	89.0625	1023.6875
5	1.25	10.3764037	0.94425273	12.6429792	1.34452271	77.2471927	272.285958	78.125	1034.5625	87.9375	260.25	88.1875	1021.3125
6	1.50	11.1888426	1.01818468	11.5492048	1.22694648	75.9973147	272.78591	77	1034.5625	87.4375	260.5625	87.9375	1023.6875
7	1.75	14.375	1.308125	11.40625	1.21222772	73	272.6875	73.375	1034.1875	86.8125	260.625	88.3125	1023.4375
8	2	16.063568	1.46178469	12.5804121	1.33797895	70.372864	273.660824	71	1034.5625	86.6875	260.375	86.8125	1022.6875
9	2.25	18.125	1.649375	11.96875	1.27252969	67.875	272.5625	69.125	1034.5625	86.0625	260.75	87.1875	1022.4375
10	2.5	19.1884032	1.74614469	12.142906	1.2926164	66.9981935	273.785812	67.625	1033.6875	85.8125	260.625	87.1875	1022.5625
11	2.75	21.75	1.97925	11.78125	1.25331444	64.125	271.8125	64	1033.5625	85.5625	260.375	86.0625	1021.4375
12	3	23.4375	2.1328125	12.46875	1.32677925	61.5	272.8125	62.125	1034.5625	85.1875	260.875	85.3125	1021.5625



Ensayo 2

TEST3 - TORNILLO3-4

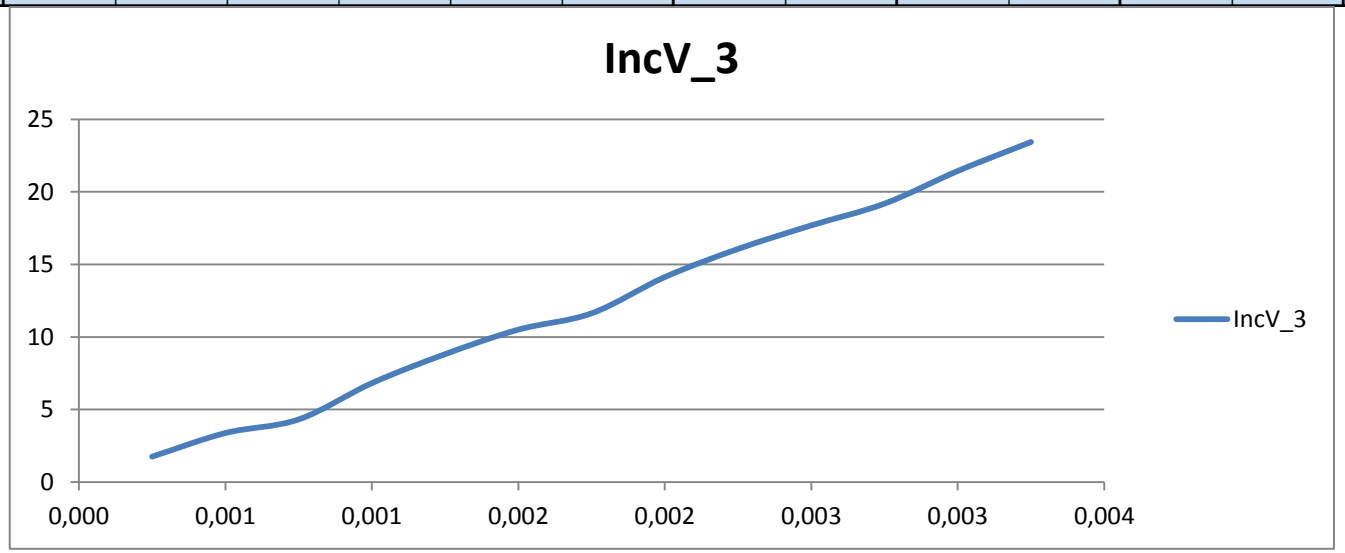
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_2	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.9375	0.1763125	12.59375	1.3394217	0.4375	0.0398125	88.8125	272.4375	89.0625	1034.9375	90.5625	260.75	91.1875	1021.4375
1	0.25	3.25	0.29575	11.6875	1.24544941	0.25	0.02275	86.5625	273.875	86.9375	1031.5625	89.9375	259.75	90.0625	1022.3125
2	0.50	4.375	0.398125	12.25	1.30205856	0.375	0.034125	85.3125	272.625	86.1875	1034.6875	90.1875	260.375	90.0625	1022.4375
3	0.75	6.4375	0.5858125	11.71875	1.24554267	0.6875	0.0625625	82.4375	272.3125	83.1875	1033.4375	88.9375	259.625	89.5625	1022.6875
4	1.00	8.68905014	0.79070356	12.0804182	1.28606792	0.12655014	0.01151606	80.2468997	273.535836	80	1034.3125	88.5625	261.375	89.0625	1022.3125
5	1.25	10.75	0.97825	13.59375	1.44815345	0.625	0.056875	77.4375	274.6875	77.9375	1034.4375	88.0625	260.5	88.8125	1021.4375
6	1.50	11.625	1.057875	12.40625	1.31958686	0.5625	0.0511875	76.25	272.5625	77.125	1034.5625	88.1875	260.625	88.4375	1021.6875
7	1.75	14.1887084	1.29117246	13.1429487	1.3986099	0.75120838	0.06835996	73.2475832	272.910897	73.875	1034.5625	87.3125	260.25	88.1875	1020.9375
8	2	15.9385863	1.45041136	12.7053693	1.35460259	0.25108632	0.02284886	70.7478274	274.535739	71.125	1033.9375	86.8125	261.5	86.9375	1021.5625
9	2.25	18.25	1.66075	12.90625	1.37300006	0.6875	0.0625625	68	272.6875	69	1035.6875	86.5625	261.375	86.9375	1021.1875
10	2.5	19.25	1.75175	12.84375	1.3673618	0.875	0.079625	66.8125	272.8125	67.9375	1035.3125	86.3125	261.625	86.9375	1020.8125
11	2.75	21.5625	1.9621875	12.59375	1.33964347	0.5	0.0455	64	272.8125	64.625	1035.5625	85.6875	261.5	86.0625	1021.6875
12	3	23.4375	2.1328125	12.96875	1.38020946	0.3125	0.0284375	61.6875	273.4375	62.0625	1034.6875	85.1875	260.625	85.4375	1021.5625



Ensayo 3

TEST3 - TORNILLO3-4

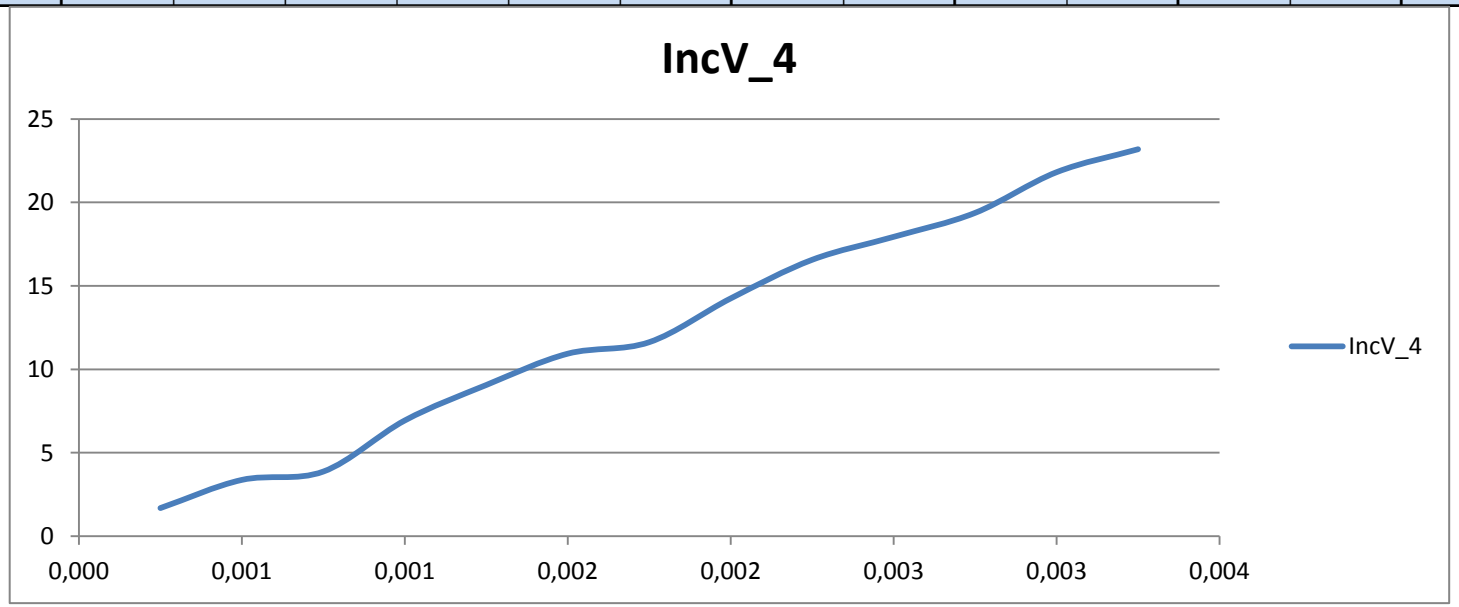
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_3	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.75	0.15925	11.625	1.23664175	0.375	0.034125	89.0625	272.625	89.1875	1034.5625	90.5625	261.5	91.1875	1022.4375
1	0.25	3.375	0.307125	11.96875	1.27526757	0.5	0.0455	87.3125	274.1875	87.1875	1031.5625	90.0625	259.375	91.1875	1022.4375
2	0.50	4.3125	0.3924375	12.34375	1.31121755	0.4375	0.0398125	85.5625	272.5	86.0625	1034.4375	89.9375	259.5625	90.3125	1022.6875
3	0.75	6.8141661	0.62008911	13.2054609	1.40169381	0.7516661	0.06840161	82.6216678	272.660922	83	1035.5625	89.0625	259.25	90.1875	1022.5625
4	1.00	8.8125	0.8019375	11.96875	1.27237307	0.09375	0.00853125	80.15625	272.59375	79.84375	1034.46875	88.5625	260.5625	89.0625	1022.5625
5	1.25	10.501422	0.9556294	14.0179182	1.49196433	0.68892198	0.0626919	77.622156	273.535836	78.375	1034.5625	88.1875	259.5	88.8125	1020.5625
6	1.50	11.6263548	1.05799829	13.5804609	1.44647453	0.81385485	0.07406079	76.2472903	272.660922	77.125	1033.6875	87.9375	259.625	88.6875	1019.5625
7	1.75	14.1262084	1.28548496	11.5180036	1.22368132	0.43870838	0.03992246	73.2475832	271.786007	74.125	1034.5625	87.8125	260.625	87.8125	1022.6875
8	2	16.0635924	1.46178691	12.9867231	1.37887169	0.00109242	9.941E-05	70.8728152	272.410946	71	1035.8125	87.0625	259.9375	86.9375	1022.3125
9	2.25	17.6875	1.6095625	12.53125	1.33135233	0.5	0.0455	68.625	272.8125	69.375	1035.4375	86.5625	260.5	86.8125	1022.6875
10	2.5	19.1875	1.7460625	11.96875	1.27379059	0.625	0.056875	67.25	272.5625	68.25	1035.4375	86.8125	262.375	87.0625	1021.6875
11	2.75	21.4375	1.9508125	12.0625	1.28212931	0.625	0.056875	63.875	272.8125	65	1034.5625	85.8125	260.4375	85.9375	1022.8125
12	3	23.4375	2.1328125	12.5625	1.33615123	0.0625	0.0056875	61.5625	273.4375	62.0625	1034.6875	85.4375	260.5625	85.0625	1022.4375



Ensayo 4

TEST3 - TORNILLO3-4

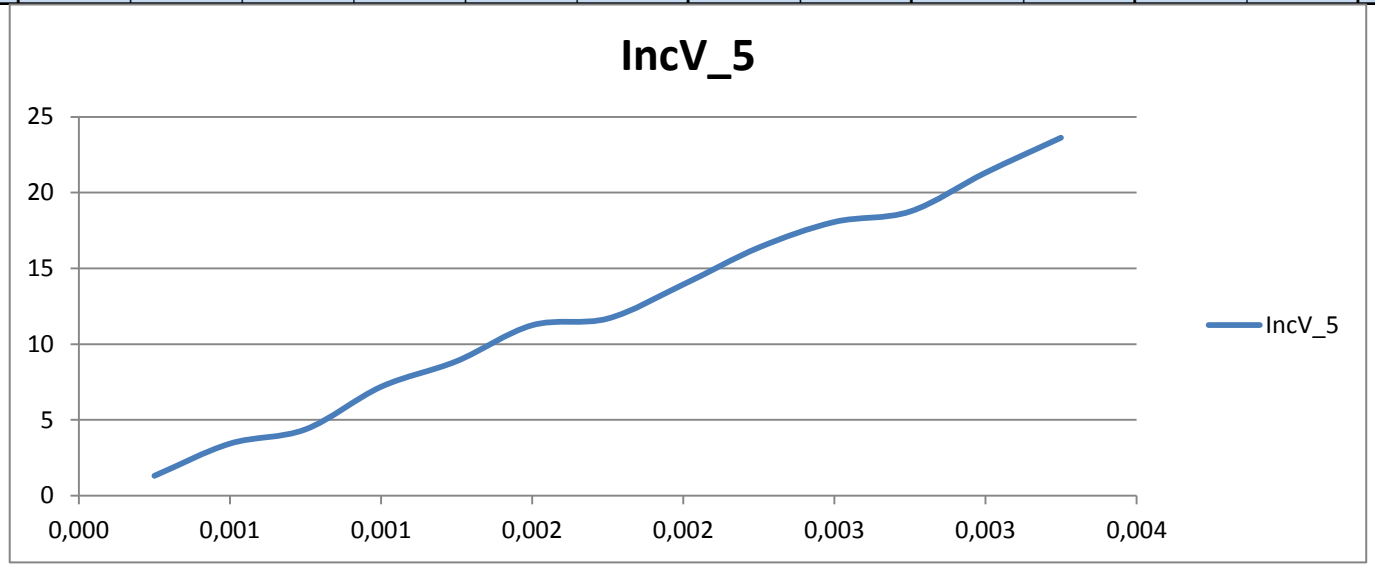
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_4	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.6875	0.1535625	11.21875	1.19347513	0.1875	0.0170625	89.0625	272.375	89.0625	1034.4375	90.5625	261.8125	90.9375	1022.5625
1	0.25	3.375	0.307125	13.28125	1.41300506	0.25	0.02275	87.0625	273.5	87.1875	1035.6875	90.3125	261.0625	90.6875	1021.5625
2	0.50	3.875	0.352625	12.9375	1.37682752	0.5	0.0455	85.6875	273.75	86.0625	1034.4375	89.4375	260.375	90.0625	1021.9375
3	0.75	6.9375	0.6313125	11.5	1.22304366	0.375	0.034125	82.875	273.5625	83	1034.5625	89.5625	261.4375	90.1875	1023.6875
4	1.00	9.0625	0.8246875	12	1.27392093	0.25	0.02275	80	272.3125	80.25	1034.3125	89.0625	259.3125	89.3125	1023.3125
5	1.25	10.9375	0.9953125	12.46875	1.32482093	0.625	0.056875	77.625	273.5625	78.125	1035.5625	88.4375	260.75	89.1875	1023.4375
6	1.50	11.6263548	1.05799829	11.6742048	1.24042907	0.81385485	0.07406079	76.2472903	272.78591	77.125	1034.5625	87.9375	260.5625	88.6875	1023.4375
7	1.75	14.25	1.29675	12.15625	1.29235881	0.5625	0.0511875	73.25	273.8125	74.125	1035.6875	87.8125	261.625	88.0625	1023.5625
8	2	16.5635863	1.50728636	12.8616499	1.36828159	-0.12391368	-0.01127614	70.7478274	273.9108	70.875	1035.1875	87.5625	260.9375	87.1875	1022.4375
9	2.25	17.9384765	1.63240136	12.7991377	1.36040431	0.25097647	0.02283886	68.4980471	274.160775	68.875	1035.4375	86.5625	260.5625	86.6875	1023.4375
10	2.5	19.375	1.763125	12.65625	1.34441331	0.6875	0.0625625	67	272.5625	68.125	1035.8125	86.8125	260.625	87.0625	1022.4375
11	2.75	21.8125	1.9849375	11.28125	1.20130702	0.4375	0.0398125	64.0625	272.4375	64.9375	1032.5625	86.3125	260.625	86.3125	1021.8125
12	3	23.1875	2.1100625	13.15625	1.40004967	0.1875	0.0170625	61.5625	273.6875	62.1875	1034.4375	85.1875	260.125	84.9375	1021.6875



Ensayo 5

TEST3 - TORNILLO3-4

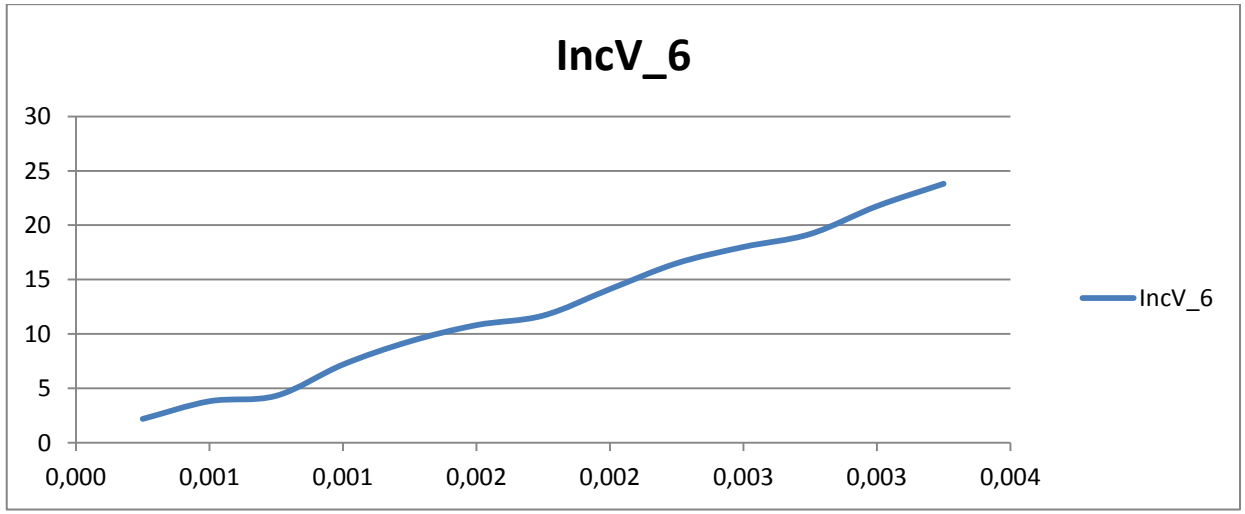
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_5	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.3125	0.1194375	10.375	1.10503105	0.6875	0.0625625	89.0625	272.6875	90.0625	1032.3125	90.6875	261.4375	91.0625	1022.8125
1	0.25	3.4375	0.3128125	13.03125	1.38470156	0.5625	0.0511875	87.0625	273.3125	87.1875	1034.9375	90.0625	259.625	91.0625	1022.5625
2	0.50	4.37680646	0.39828939	13.5491743	1.43894388	0.68930646	0.06272689	85.4963871	273.410849	86	1035.5625	89.6875	259.3125	90.5625	1022.5625
3	0.75	7.1875	0.6540625	13.21875	1.40750975	0.3125	0.0284375	82.6875	274.0625	83.1875	1035.1875	90.0625	261.25	90.1875	1021.5625
4	1.00	8.87653794	0.80776495	12.1741804	1.29482698	0.18903794	0.01720245	79.9969241	273.285861	80.25	1034.4375	88.9375	260.6875	89.0625	1022.6875
5	1.25	11.25	1.02375	12.875	1.37265849	0.5	0.0455	77.4375	273.4375	77.9375	1034.3125	88.6875	261.6875	89.1875	1020.3125
6	1.50	11.6875	1.0635625	14.3125	1.52278147	0.25	0.02275	76.75	273.5625	76.75	1035.0625	88.1875	259.4375	88.6875	1020.5625
7	1.75	13.9387267	1.26842413	11.8304731	1.2575997	0.50122669	0.04561163	73.6225466	272.410946	74	1034.5625	87.4375	260.75	88.0625	1022.5625
8	2	16.375	1.490125	13.78125	1.46632021	0.125	0.011375	70.8125	274.9375	71.3125	1035.5625	87.5625	260.5	87.3125	1022.4375
9	2.25	18.0634765	1.64377636	12.8303755	1.3656831	0.62597647	0.05696386	68.4980471	274.410751	69.25	1035.3125	86.6875	261.5	87.1875	1022.5625
10	2.5	18.75	1.70625	12.6875	1.34967158	0.625	0.056875	67.8125	272.8125	68.1875	1035.5625	86.3125	261.4375	87.1875	1021.5625
11	2.75	21.3125	1.9394375	12.28125	1.30564944	0.6875	0.0625625	64.3125	272.6875	65.1875	1035.4375	85.8125	261.25	86.3125	1022.3125
12	3	23.625	2.149875	12.84375	1.36870769	0.375	0.034125	61.6875	273.3125	62.0625	1034.5625	85.3125	261.625	85.6875	1020.5625



Ensayo 6

TEST3 - TORNILLO3-4

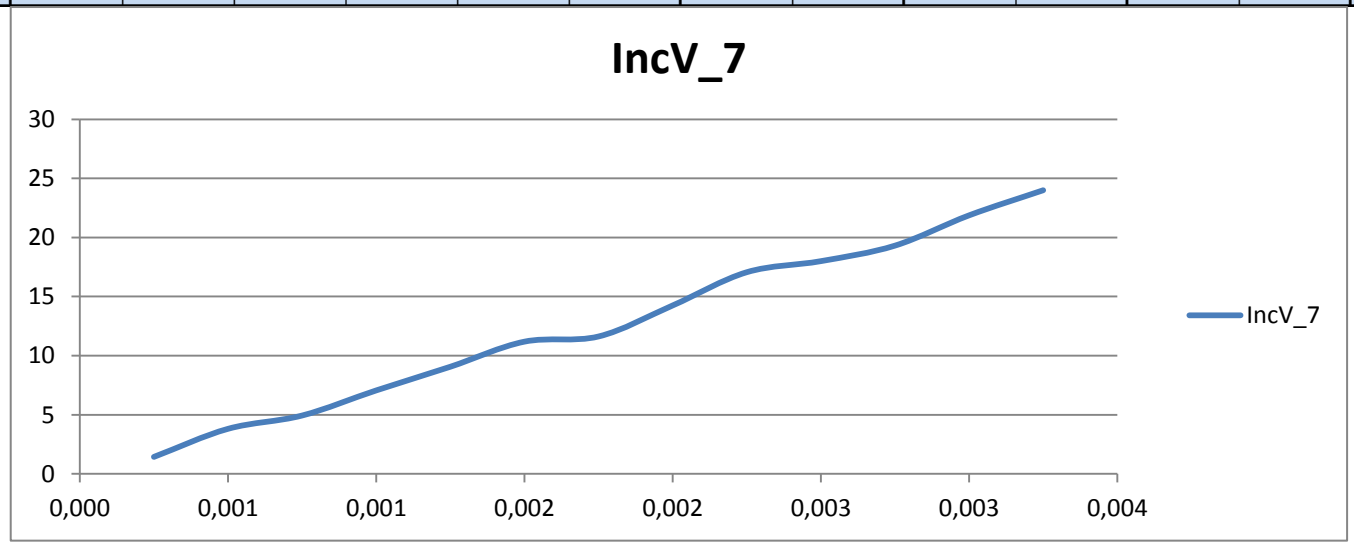
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_6	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	2.1875	0.1990625	13.1875	1.40274207	0.5625	0.0511875	88.3125	273.375	88.8125	1035.4375	90.4375	260.75	91.0625	1021.6875
1	0.25	3.8125	0.3469375	12.0625	1.28550285	0.5625	0.0511875	86.8125	273.4375	87.1875	1033.4375	90.4375	261.3125	91.1875	1021.4375
2	0.50	4.3125	0.3924375	13.6875	1.4559266	0.3125	0.0284375	85.6875	273.625	86.1875	1035.6875	90.1875	260.5	90.3125	1021.4375
3	0.75	7.18914779	0.65421245	10.5804426	1.1276856	0.87664779	0.07977495	82.2467044	273.035885	83.125	1031.1875	89.4375	260.625	90.3125	1022.4375
4	1.00	9.3125	0.8474375	12.90625	1.37074389	0.3125	0.0284375	79.4375	272.9375	79.9375	1035.3125	88.9375	259.75	89.0625	1022.6875
5	1.25	10.8125	0.9839375	12.375	1.31610101	0.1875	0.0170625	77.9375	273.4375	78.1875	1034.5625	88.8125	260.5625	88.9375	1022.6875
6	1.50	11.6875	1.0635625	13.25	1.40869565	0.5625	0.0511875	76.6875	273.8125	77.0625	1035.6875	88.1875	260.5625	88.9375	1022.4375
7	1.75	14.125	1.285375	13.5	1.43621772	0.875	0.079625	72.9375	273.8125	74.0625	1035.5625	87.3125	260.6875	87.9375	1021.6875
8	2	16.5	1.5015	13.71875	1.45859294	0.4375	0.0398125	70.25	273.3125	71	1035.9375	87.0625	260.375	87.1875	1021.4375
9	2.25	18	1.638	14.28125	1.51877135	0.25	0.02275	68.6875	274.3125	69.3125	1036.4375	87.0625	260.5	86.9375	1021.6875
10	2.5	19.1884032	1.74614469	13.2991804	1.4147121	0.75090323	0.06833219	66.9981935	273.285861	67.75	1034.9375	86.1875	260.1875	86.9375	1021.4375
11	2.75	21.75	1.97925	13.1875	1.40216748	0	0	64.1875	272.9375	64.1875	1035.5625	85.9375	260.5625	85.9375	1021.5625
12	3	23.8125	2.1669375	14.03125	1.49341035	0.375	0.034125	61.125	273.9375	62.125	1035.5625	85.5625	260.5	85.3125	1020.9375



Ensayo 7

TEST3 - TORNILLO3-4

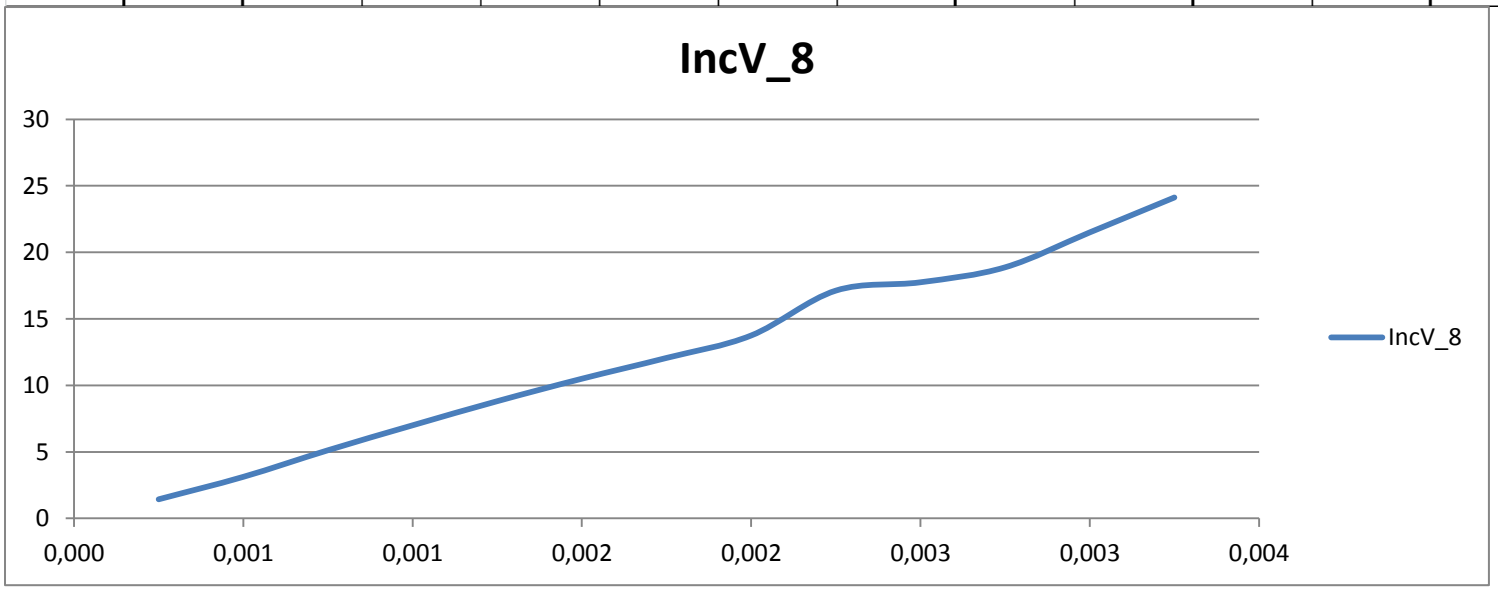
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_7	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.4375	0.1308125	11.71875	1.2467731	0.1875	0.0170625	89.5625	273.6875	89.6875	1033.4375	90.9375	260.375	91.1875	1023.3125
1	0.25	3.8125	0.3469375	11.875	1.26199262	0.1875	0.0170625	87.3125	273.5	87.1875	1035.6875	90.8125	261.625	91.3125	1023.8125
2	0.50	4.9375	0.4493125	12.46875	1.32514739	0.5625	0.0511875	85.5625	273.75	85.8125	1035.3125	90.1875	260.6875	91.0625	1023.4375
3	0.75	7.0625	0.6426875	13.53125	1.43924728	0.4375	0.0398125	82.6875	274.6875	82.9375	1035.6875	89.5625	260.625	90.1875	1022.6875
4	1.00	9.06403794	0.82482745	13.8929548	1.47964195	0.37653794	0.03426495	79.9969241	272.78591	80.5	1034.8125	89.1875	260.375	89.4375	1019.4375
5	1.25	11.1875	1.0180625	13.71875	1.46291192	0.1875	0.0170625	77.5625	274.6875	77.8125	1034.3125	88.8125	261	88.9375	1020.5625
6	1.50	11.6263793	1.05800051	13.7366132	1.46280543	0.56387926	0.05131301	76.7472415	274.660726	77.125	1035.6875	88.1875	261.3125	88.9375	1021.5625
7	1.75	14.2512023	1.29685941	13.1429182	1.39654227	0.68870228	0.06267191	73.1225954	273.535836	74.25	1036.1875	87.8125	260.75	88.0625	1022.6875
8	2	17.0625	1.5526875	14.34375	1.5260452	0.125	0.011375	71	274.8125	70.875	1036.9375	87.8125	261.25	88.1875	1021.8125
9	2.25	18	1.638	13.78125	1.46607841	0.375	0.034125	68.6875	275.0625	69.1875	1036.5625	86.8125	261.375	87.0625	1022.6875
10	2.5	19.3125	1.7574375	12.8125	1.36207523	0.375	0.034125	67.3125	273.1875	67.8125	1036.5625	86.75	261.8125	87	1022.3125
11	2.75	21.875	1.990625	12.90625	1.37209308	0.5625	0.0511875	63.75	273.4375	64.75	1035.1875	86.0625	260.375	86.1875	1022.4375
12	3	23.9981874	2.18383506	12.7002582	1.35300135	0.75181257	0.06841494	61.125	274.8125	62.375	1034.8125	85.6213749	261.786984	85.875	1022.4375



Ensayo 8

TEST3 - TORNILLO3-4

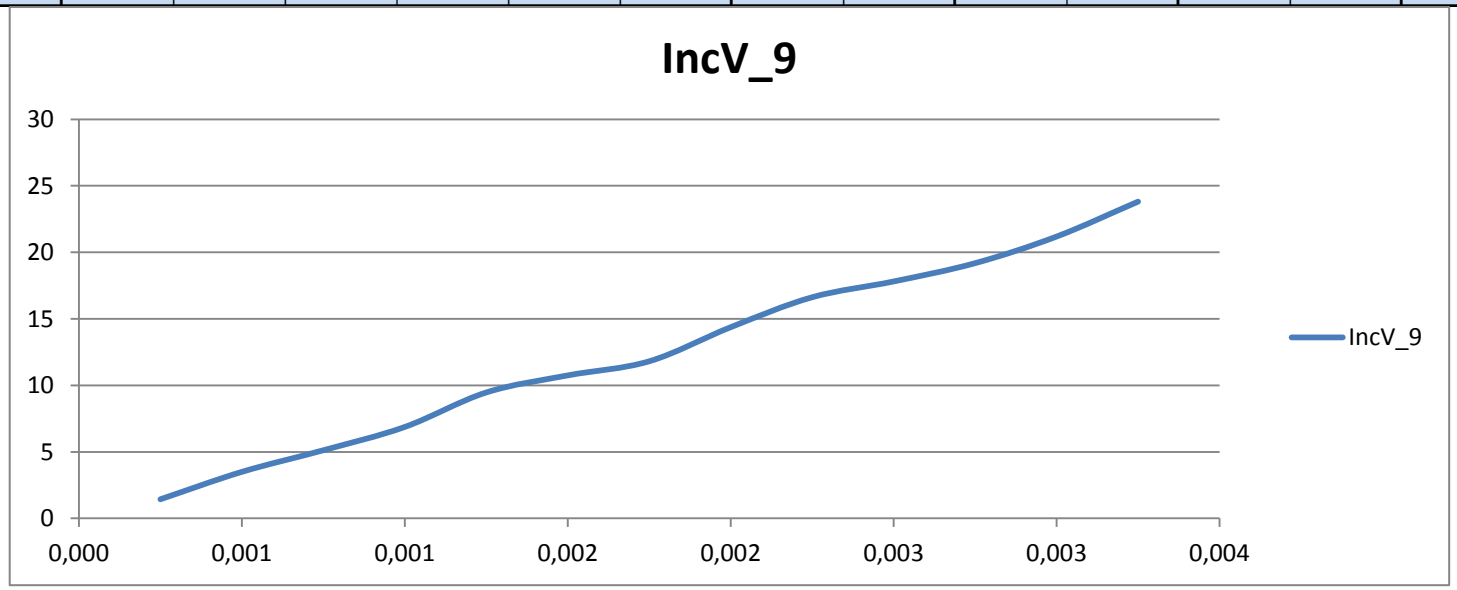
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_8	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.4375	0.1308125	13.15625	1.39855643	0.3125	0.0284375	89.3125	273.875	90.0625	1035.6875	91.1875	260.5625	91.0625	1022.6875
1	0.25	3.125	0.284375	11.0625	1.17990296	0.5	0.0455	87.5625	273.8125	88.0625	1033.4375	90.6875	262.9375	91.1875	1022.1875
2	0.50	5.125	0.466375	12.84375	1.36837208	0.625	0.056875	85.4375	274.625	85.9375	1033.4375	90.4375	260.3125	91.1875	1022.0625
3	0.75	7	0.637	12.1875	1.29648507	0.375	0.034125	82.4375	274.6875	83.0625	1034.4375	89.6875	260.8125	89.8125	1023.9375
4	1.00	8.8125	0.8019375	11.875	1.2625108	0.0625	0.0056875	80.3125	273.5625	80.8125	1034.9375	89.5625	261.1875	89.1875	1023.5625
5	1.25	10.5	0.9555	11.6875	1.24145703	0.25	0.02275	78.4375	272.6875	78.4375	1034.4375	88.6875	260.1875	89.1875	1023.5625
6	1.50	12.0638671	1.0978119	12.8303755	1.36344688	0.50136705	0.0456244	76.4972659	274.410751	76.875	1035.4375	88.4375	260.375	89.0625	1023.8125
7	1.75	13.75	1.25125	13.4375	1.42898248	0.125	0.011375	73.9375	274.4375	74.4375	1035.5625	88.0625	260.4375	87.8125	1022.6875
8	2	17.1230715	1.5581995	13.5752154	1.44526315	0.31442852	0.028613	70.3125	274.8125	71.1875	1035.3125	87.996143	260.912069	87.75	1022.0625
9	2.25	17.75	1.61525	13.46875	1.4306043	0.1875	0.0170625	69.125	273.1875	69	1036.5625	86.5625	260.5	87.0625	1022.3125
10	2.5	18.875	1.717625	13.15625	1.39844291	0.375	0.034125	67.9375	273.5625	68.0625	1036.3125	86.5625	261.125	87.1875	1022.4375
11	2.75	21.5	1.9565	13.5	2.44357847	-0.5	-0.0455	65	274	63	722	85	261	86	708



Ensayo 9

TEST3 - TORNILLO3-4

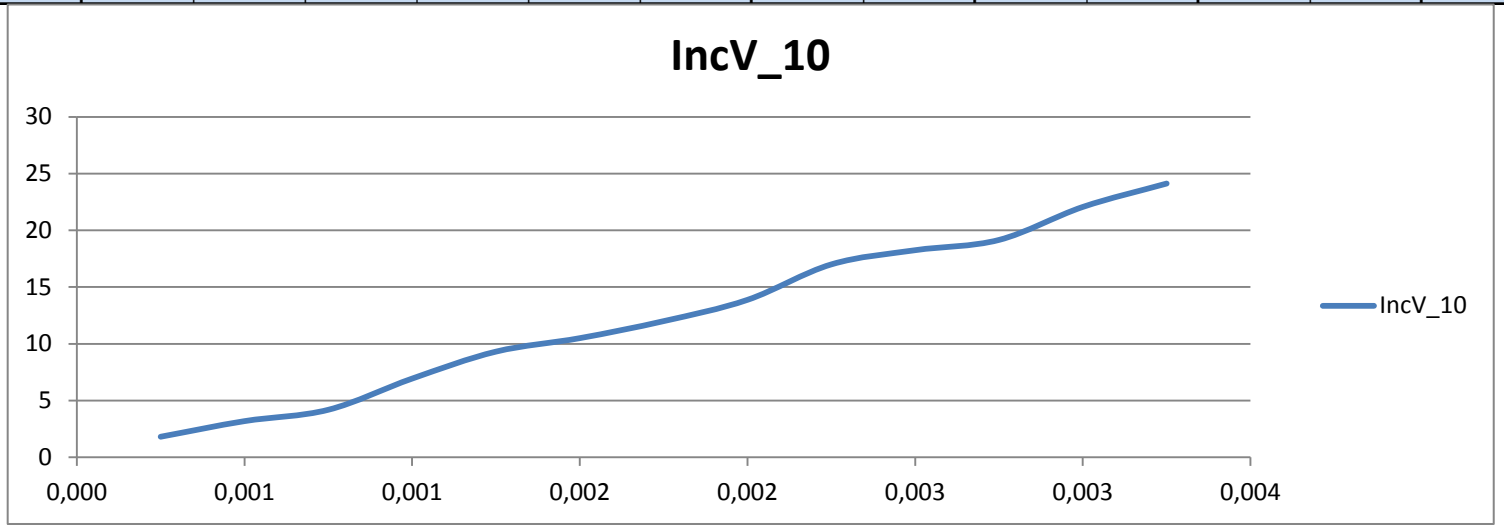
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_9	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.43949565	0.1309941	12.6741438	1.34689717	0.50199565	0.0456816	89.3710087	274.035788	90.125	1035.6875	91.0625	260.8125	91.3125	1023.5625
1	0.25	3.5	0.3185	11	1.17083699	0.625	0.056875	86.9375	273.6875	87.9375	1032.5625	90.8125	260.5625	91.0625	1023.6875
2	0.50	5.125	0.466375	12.9375	1.37535888	0.875	0.079625	85.4375	273.5625	85.9375	1035.5625	90.1875	260.6875	91.4375	1022.5625
3	0.75	6.87665999	0.62577606	12.5491621	1.3338335	0.68915999	0.06271356	82.49668	273.660824	83.125	1035.4375	89.3125	260.8125	90.0625	1023.1875
4	1.00	9.46875	0.86165625	13.375	1.42087859	0.5	0.0455	79.96875	273.59375	80.09375	1035.53125	89.0625	259.6875	89.9375	1022.6875
5	1.25	10.7514464	0.97838162	13.3929182	1.42427482	0.06394639	0.00581912	78.1221072	273.535836	78	1035.6875	88.6875	260.625	88.9375	1021.8125
6	1.50	11.8125	1.0749375	13.625	1.45118908	0.6875	0.0625625	76.4375	275.5625	77.1875	1034.5625	88.3125	260.4375	88.9375	1022.4375
7	1.75	14.375	1.308125	14.40625	1.5310594	0.5625	0.0511875	73.25	274.5625	73.875	1037.0625	87.6875	260.5	88.1875	1022.3125
8	2	16.625	1.512875	14.21875	1.51448537	0.5	0.0455	70.9375	275.9375	71.0625	1036.5625	87.1875	261.875	88.0625	1022.1875
9	2.25	17.8125	1.6209375	14.375	1.52805381	-0.1875	-0.0170625	68.9375	275.4375	68.9375	1036.4375	86.9375	260.0625	86.5625	1023.0625
10	2.5	19.1875	1.7460625	12.21875	1.29975003	0.6875	0.0625625	66.9375	273.3125	67.9375	1035.1875	86.4375	261.5	86.8125	1022.5625
11	2.75	21.1875	1.9280625	13.59375	1.44553887	0.0625	0.0056875	64.6875	274.4375	65.1875	1036.5625	86.3125	261.25	85.9375	1022.5625
12	3	23.8125	2.1669375	13.25	1.40962075	0.25	0.02275	61.9375	274.5625	61.8125	1035.9375	85.375	261.3125	86	1022.6875



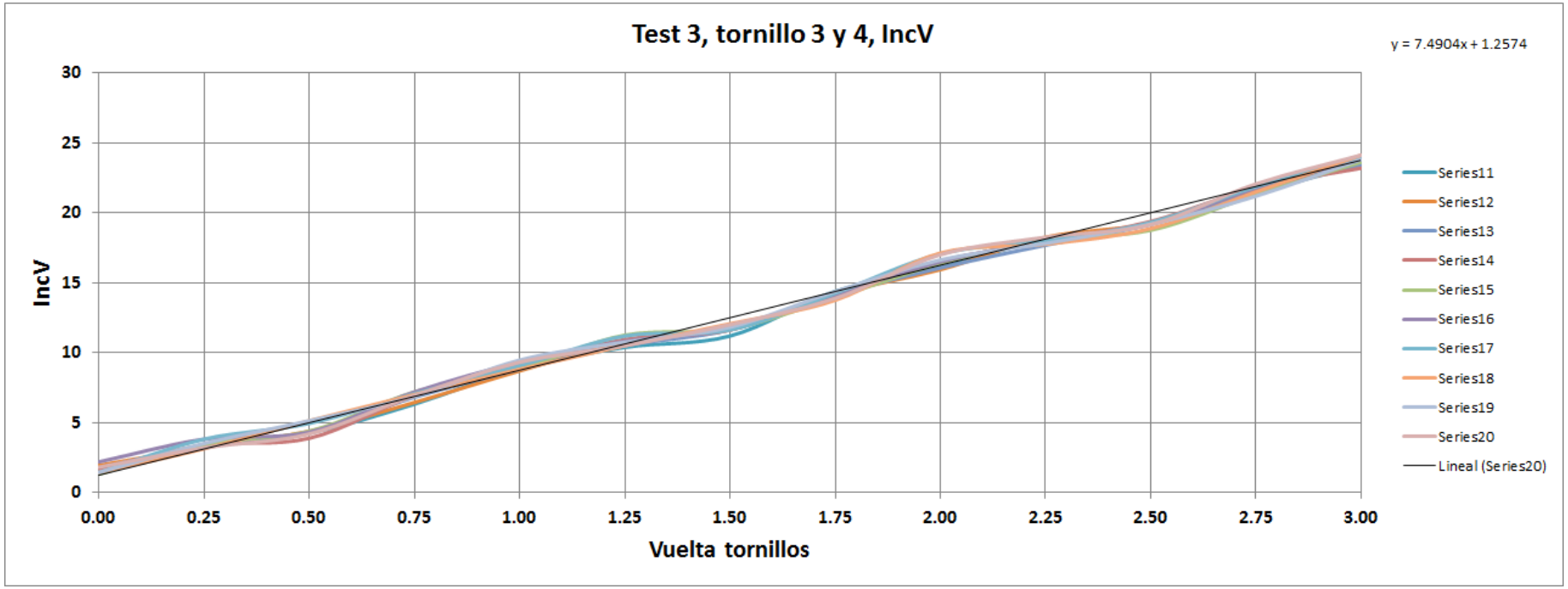
Ensayo 10

TEST3 - TORNILLO3-4

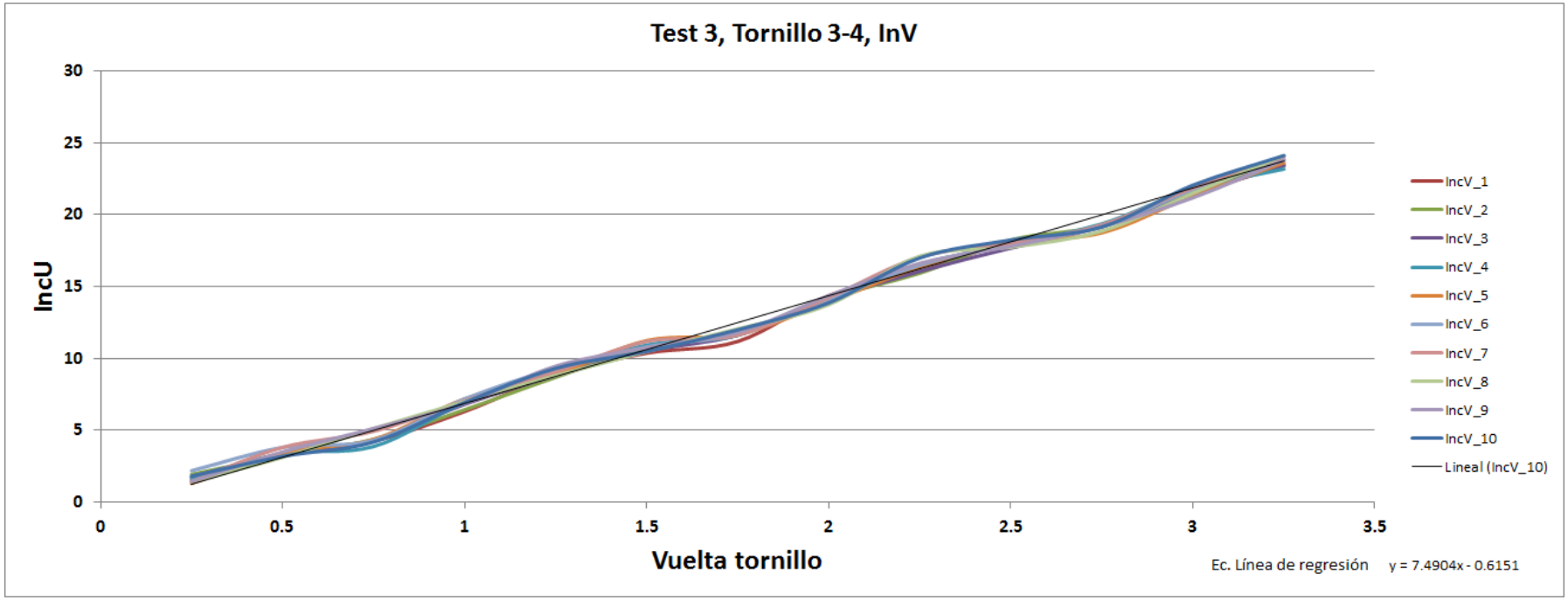
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_10	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.8125	0.1649375	13.34375	1.41813986	0.1875	0.0170625	89.0625	273.625	89.3125	1035.3125	90.9375	259.8125	91.0625	1022.4375
1	0.25	3.1875	0.2900625	13.25	1.40881137	0.9375	0.0853125	87.0625	273.5	88.1875	1035.5625	90.4375	260.5	91.1875	1022.0625
2	0.50	4.1875	0.3810625	12.875	1.36916755	0.5625	0.0511875	86.3125	274.75	86.0625	1035.1875	89.6875	260.625	91.0625	1023.5625
3	0.75	6.9375	0.6313125	14.21875	1.51100828	-0.0625	-0.0056875	82.9375	274.8125	82.8125	1036.8125	89.8125	260.375	89.8125	1022.8125
4	1.00	9.31405014	0.84757856	13.9242109	1.48339928	-0.12344986	-0.01123394	80.2468997	272.660922	80	1034.6875	89.4375	260.4375	89.4375	1019.0625
5	1.25	10.5	0.9555	14.21875	1.51423856	0.5625	0.0511875	77.625	273.9375	78.875	1035.4375	88.8125	260.625	88.6875	1020.3125
6	1.50	12	1.092	13.40625	1.42830124	0.25	0.02275	76.5625	275.6875	76.9375	1034.4375	88.6875	260.75	88.8125	1022.5625
7	1.75	13.875	1.262625	15.625	1.66256229	0.3125	0.0284375	73.625	274.6875	74.25	1036.4375	87.8125	259.5625	87.8125	1020.3125
8	2	17.0010741	1.54709774	13.9241682	1.482906	0.68857411	0.06266024	70.4978518	273.535836	71.25	1035.6875	87.5625	261.1875	88.1875	1020.1875
9	2.25	18.25	1.66075	14.8125	1.57442805	0.125	0.011375	68.6875	274.1875	69.1875	1036.4375	87.3125	259.5625	87.0625	1021.4375
10	2.5	19.15625	1.74321875	14.5	1.54241507	0.78125	0.07109375	67.125	274.5625	68.125	1036.6875	86.5	260.71875	87.0625	1021.53125
11	2.75	22.0625	2.0076875	13.15625	1.39867398	0.75	0.06825	64	272.5625	65	1035.5625	86.3125	260.5	86.8125	1021.3125
12	3	24.125	2.195375	13.40625	1.42712246	0.375	0.034125	61.4375	275.0625	61.9375	1035.6875	85.6875	261.375	85.9375	1022.5625



Incremento de U relativo



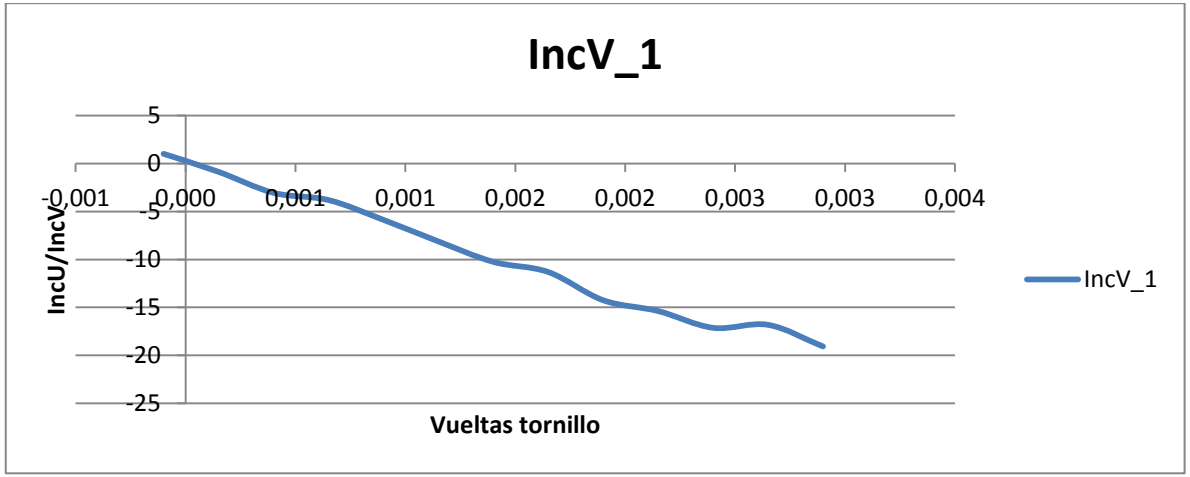
Incremento de U absoluto



1.4. Ensayo Rotación Tornillo X, tornillos 5 y 6

Ensayo 1

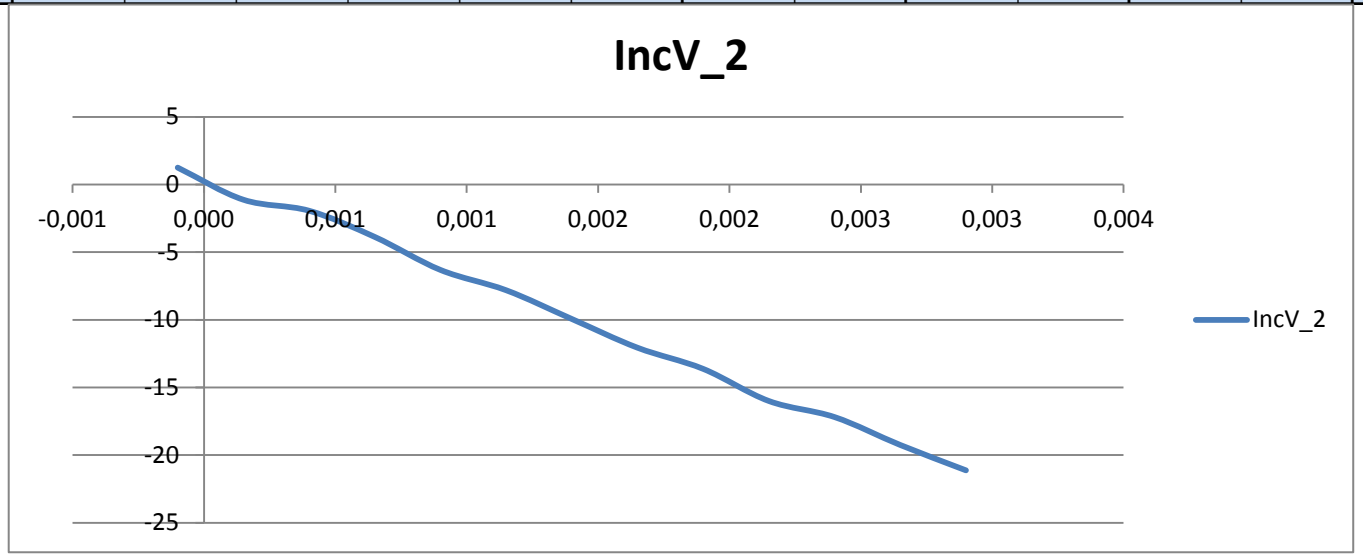
TEST4 - TORNILLO5-6													
Posiciones tornillo	Rotación del tornillo	Incremetos				puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_1	IncZ	IncU_1	IncX	v	u	v	u	v	u	v	u
0	0.00	1	0.091	12.75	1.35866432	89.6875	275.0625	89.9375	1033.5625	90.4375	260.6875	91.1875	1022.4375
1	0.25	-0.875	-0.079625	14.25	1.51588344	89.0625	273.375	89.0625	1035.3125	88.1875	259.625	88.1875	1020.5625
2	0.50	-3.0625	-0.2786875	12.6875	1.34944678	88.8125	274.4375	88.8125	1035.4375	85.25	261.1875	86.25	1023.3125
3	0.75	-3.8125	-0.3469375	12.0625	1.28360439	87.9375	273.4375	87.9375	1035.4375	83.9375	262.1875	84.3125	1022.5625
4	1.00	-5.875	-0.534625	13	1.38336485	87.6875	274.5	88.1875	1035.8125	82.0625	261.625	82.0625	1022.6875
5	1.25	-8.125	-0.739375	12	1.27579987	87.5625	273.5625	87.0625	1035.5625	79.125	261.6875	79.25	1023.4375
6	1.50	-10.251361	-0.93287385	11.8252521	1.25895587	86.9375	273.4375	86.6875	1034.3125	76.3722781	261.661996	76.75	1022.4375
7	1.75	-11.3125	-1.0294375	11.59375	1.23438078	86.3125	273.125	86.5625	1033.9375	74.75	261.5625	75.5	1022.3125
8	2	-14.25	-1.29675	11.75	1.24901575	86.4375	273.4375	86.3125	1035.4375	72.25	261.6875	72	1023.6875
9	2.25	-15.375	-1.399125	12.90625	1.37153054	85.8125	274.5	85.9375	1036.5625	70.875	261.4375	70.125	1023.8125
10	2.5	-17.125	-1.558375	11.4375	1.21529983	84.9375	272.8125	85.0625	1034.4375	67.5	260.6875	68.25	1023.6875
11	2.75	-16.8125	-1.5299375	11.71875	1.24462456	85.1875	273	84.8125	1034.5625	68.25	260.1875	68.125	1023.9375
12	3	-19.0625	-1.7346875	14.1875	1.51047572	84.4375	275.6875	85.1875	1035.6875	64.875	260.6875	66.625	1022.3125



Ensayo 2

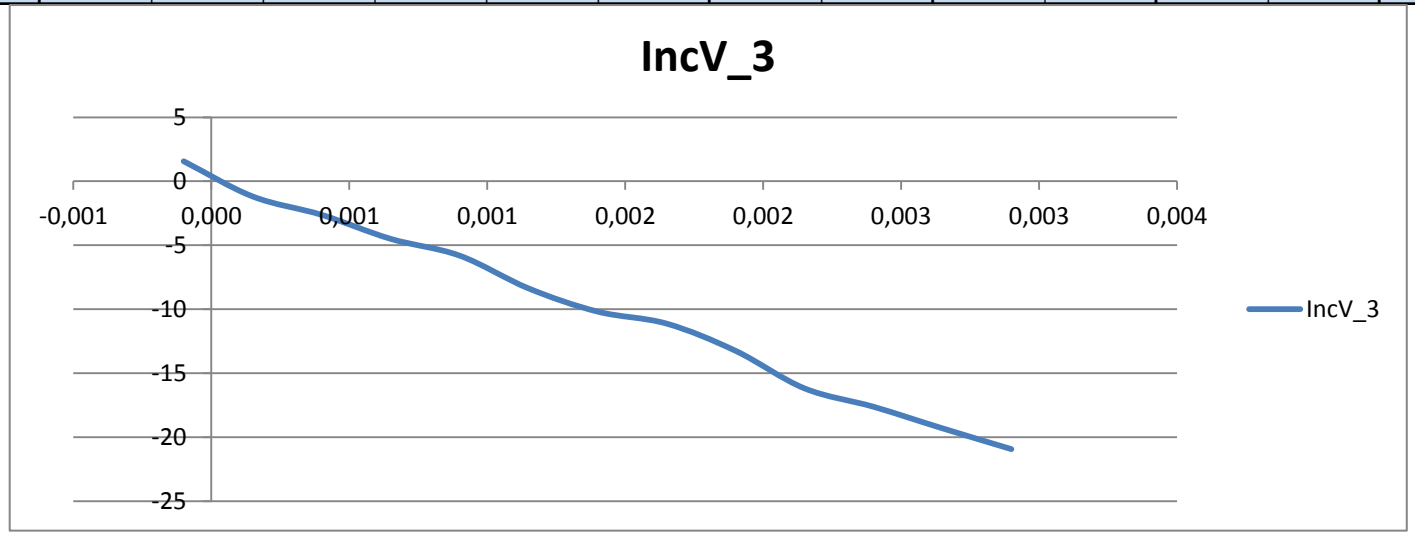
TEST4 - TORNILLO5-6

Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_2	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.25	0.11375	13.1875	1.40308754	-0.75	-0.06825	89.9375	273.4375	88.8125	1035.3125	90.8125	260.8125	90.4375	1021.5625
1	0.25	-1.1240128	-0.10228517	12.649586	1.34507185	0.0009872	8.9835E-05	88.9355256	273.455422	89.1875	1034.46875	88.0625	260.0625	87.8125	1022.5625
2	0.50	-1.9375	-0.1763125	12.84375	1.36567339	0.1875	0.0170625	87.9375	273.75	88.6875	1034.9375	86.5625	260.3125	86.1875	1022.6875
3	0.75	-3.875	-0.352625	13.34375	1.42000316	0.3125	0.0284375	88.0625	273.875	88.1875	1035.5625	84	261.0625	84.5	1021.6875
4	1.00	-6.3125	-0.5744375	13.46875	1.4351912	0.1875	0.0170625	87.6875	274.25	87.8125	1035.0625	81.3125	261.4375	81.5625	1020.9375
5	1.25	-7.81401963	-0.71107579	13.1377032	1.39627521	0.12651963	0.01151329	87.0625	273.6875	87.5625	1035.9375	79.6219607	260.662094	79.375	1022.6875
6	1.50	-9.9375	-0.9043125	12.375	1.31696516	-0.25	-0.02275	87.3125	273.4375	86.9375	1034.3125	77.25	260.8125	77.125	1022.1875
7	1.75	-12.0625	-1.0976875	13.375	1.42338643	0.125	0.011375	87.0625	274.3125	86.6875	1035.4375	74.5	260.9375	75.125	1022.0625
8	2	-13.6261901	-1.2399833	13.0126971	1.38163286	-0.43630993	-0.0397042	86.4375	272.4375	86.0625	1036.4375	72.8726199	260.537106	72.375	1022.3125
9	2.25	-16	-1.456	13.4375	1.42898171	-0.1875	-0.0170625	86.1875	274.1875	85.8125	1035.9375	70	260.8125	70	1022.4375
10	2.5	-17.1884276	-1.56414692	11.4502398	1.2176309	0.37592764	0.03420942	84.8125	273.3125	85.0625	1034.5625	67.4981447	261.41202	68	1023.5625
11	2.75	-19.2490724	-1.75166558	12.999408	1.38314272	0.75257543	0.06848436	84.3714969	273.410849	85.375	1035.5625	65.3733522	261.287033	65.875	1021.6875
12	3	-21.125	-1.922375	13.0625	1.39001568	0.5625	0.0511875	83.9375	274.1875	84.5625	1035.1875	62.875	260.9375	63.375	1022.3125



Ensayo 3

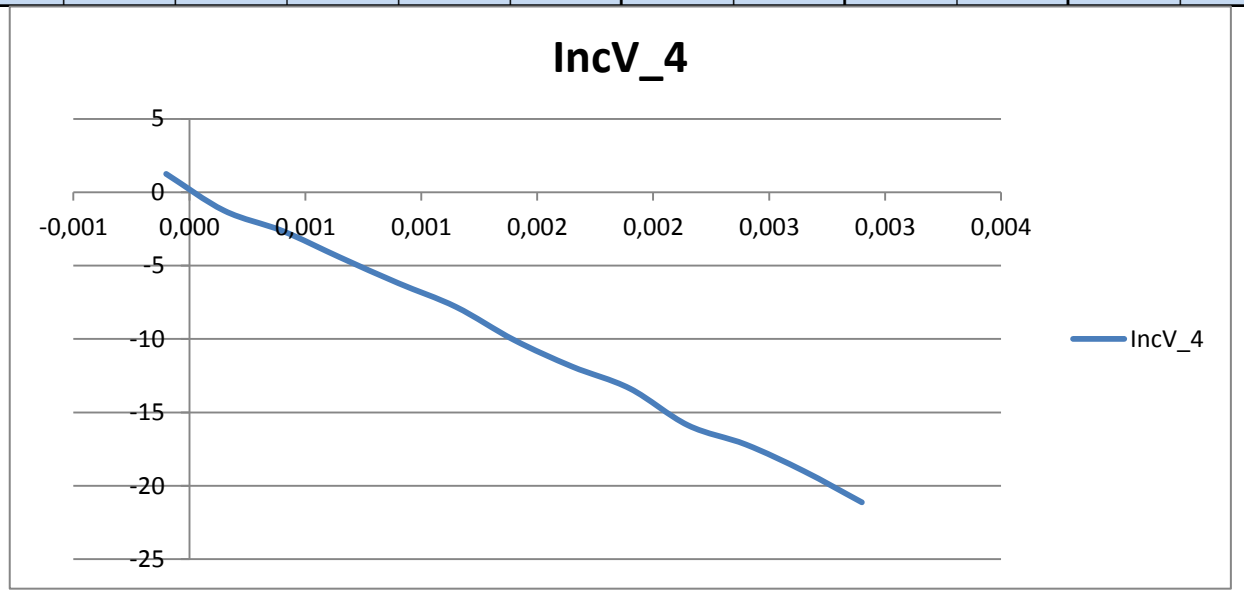
TEST4 - TORNILLO5-6															
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_3	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.5625	0.1421875	14.40625	1.53559239	0.0625	0.0056875	89.4375	274.9375	89.1875	1034.8125	90.6875	260.5	91.0625	1020.4375
1	0.25	-1.1875	-0.1080625	13.21875	1.40554627	-0.6875	-0.0625625	89.8125	273.75	89.1875	1035.6875	88.6875	260.6875	87.9375	1022.3125
2	0.50	-2.625	-0.238875	13.59375	1.44589492	-0.125	-0.011375	88.6875	273.625	88.5625	1034.6875	86.0625	259.5625	85.9375	1021.5625
3	0.75	-4.5	-0.4095	12.6875	1.34756642	0.125	0.011375	88.5625	272.75	88.1875	1035.8125	83.5625	260.5	84.1875	1022.6875
4	1.00	-5.8125	-0.5289375	13.3125	1.41638664	0.75	0.06825	87.375	274.5625	87.875	1035.4375	81.3125	260.8125	82.3125	1022.5625
5	1.25	-8.375	-0.762125	13.65625	1.45325985	-0.75	-0.06825	88.0625	275.0625	86.9375	1035.3125	79.3125	260.5	78.9375	1022.5625
6	1.50	-10.1875	-0.9270625	13.15625	1.40039548	0.625	0.056875	86.9375	273.5	87.0625	1035.1875	76.25	261.0625	77.375	1021.3125
7	1.75	-11.1263121	-1.0124944	13.1064349	1.39266653	0.56381213	0.0513069	85.9375	273.5	87.0625	1035.6875	75.3723757	260.28713	75.375	1022.6875
8	2	-13.2511535	-1.20585496	11.9189715	1.2663856	0.93865345	0.08541746	85.5625	272.375	86.3125	1035.3125	72.1226931	261.037057	73.25	1022.8125
9	2.25	-16.1875	-1.4730625	11.875	1.26251029	0.125	0.011375	86.0625	273.6875	86.3125	1035.4375	70	261.6875	70	1023.6875
10	2.5	-17.625	-1.603875	13.15625	1.39741044	0.4375	0.0398125	84.9375	272.875	85.0625	1035.8125	67	260.0625	67.75	1022.3125
11	2.75	-19.3125	-1.7574375	13.03125	1.38686326	0.9375	0.0853125	84.3125	273.625	85.3125	1035.6875	65.0625	261.5625	65.9375	1021.6875
12	3	-20.9375	-1.9053125	12.125	1.28930095	-0.1875	-0.0170625	84.375	272.9375	84.25	1034.6875	63.5	260.8125	63.25	1022.5625



Ensayo 4

TEST4 - TORNILLO5-6

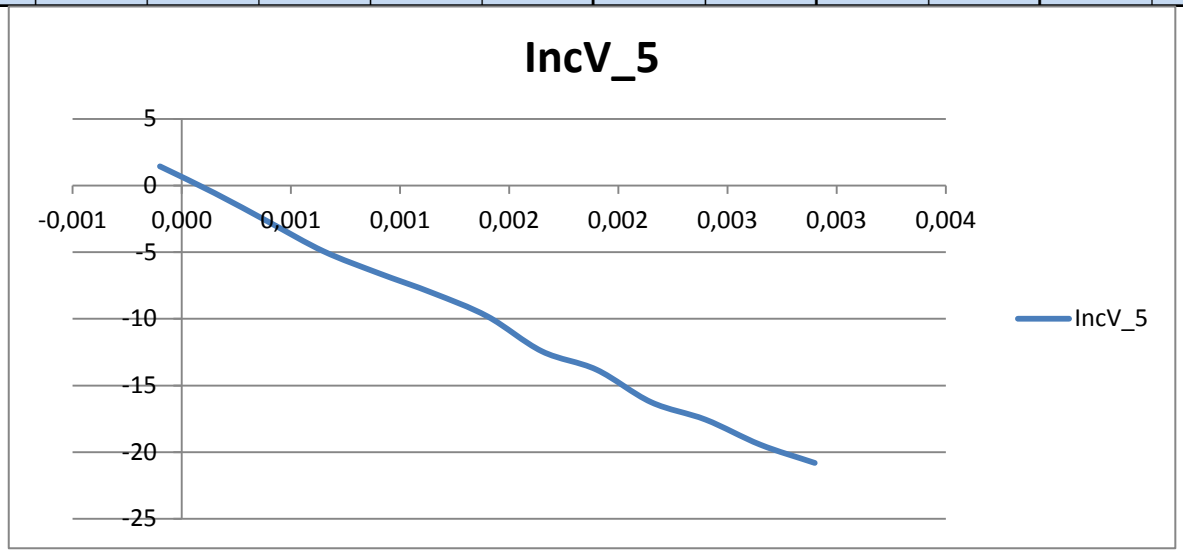
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_4	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.25	0.11375	13.8125	1.47200115	0.125	0.011375	89.6875	274.8125	89.5625	1034.4375	90.6875	260.5625	91.0625	1021.0625
1	0.25	-1.25	-0.11375	12.5625	1.33527507	-0.75	-0.06825	89.9375	272.9375	88.9375	1035.5625	88.4375	260.9375	87.9375	1022.4375
2	0.50	-2.625	-0.238875	13.78125	1.46571787	0.25	0.02275	88.4375	273.875	89.0625	1035.0625	86.1875	259.6875	86.0625	1021.6875
3	0.75	-4.4375	-0.4038125	13.15625	1.39970476	-0.3125	-0.0284375	88.3125	273.625	88.0625	1035.3125	83.9375	260.8125	83.5625	1021.8125
4	1.00	-6.1875	-0.5630625	15.09375	1.60874334	0.3125	0.0284375	87.5625	274.9375	88.1875	1035.5625	81.6875	260.5	81.6875	1019.8125
5	1.25	-7.8125	-0.7109375	12.65625	1.34828098	-0.3125	-0.0284375	87.0625	274.25	87.1875	1033.9375	79.6875	260.9375	78.9375	1021.9375
6	1.50	-10.0638671	-0.9158119	13.3564654	1.42203335	0.62636705	0.0569994	86.3125	274.875	87.1875	1035.0625	76.4972659	260.912069	76.875	1022.3125
7	1.75	-11.8731447	-1.08045617	13.6115949	1.44901699	0.50185529	0.04566883	86.4962894	275.03569	87.25	1035.1875	74.875	260.6875	75.125	1022.3125
8	2	-13.375	-1.217125	12.6875	1.35033304	-0.1875	-0.0170625	85.9375	273.6875	85.9375	1035.1875	72.75	261.4375	72.375	1022.0625
9	2.25	-15.8760558	-1.44472108	12.6377154	1.34357721	-0.18644419	-0.01696642	86.0625	273.4375	85.8125	1035.4375	70.1228884	260.912069	70	1022.6875
10	2.5	-17.1875	-1.5640625	12.34375	1.31121813	-0.1875	-0.0170625	85.4375	272.375	85.1875	1035.6875	68.1875	260.8125	68.0625	1022.5625
11	2.75	-19	-1.729	12.875	1.37085413	0.375	0.034125	84.875	273.8125	84.875	1035.6875	65.5	262.0625	66.25	1021.6875
12	3	-21.125	-1.922375	13.5	1.4366938	-0.125	-0.011375	84.4375	275.8125	83.9375	1035.5625	62.9375	260.9375	63.1875	1023.4375



Ensayo 5

TEST4 - TORNILLO5-6

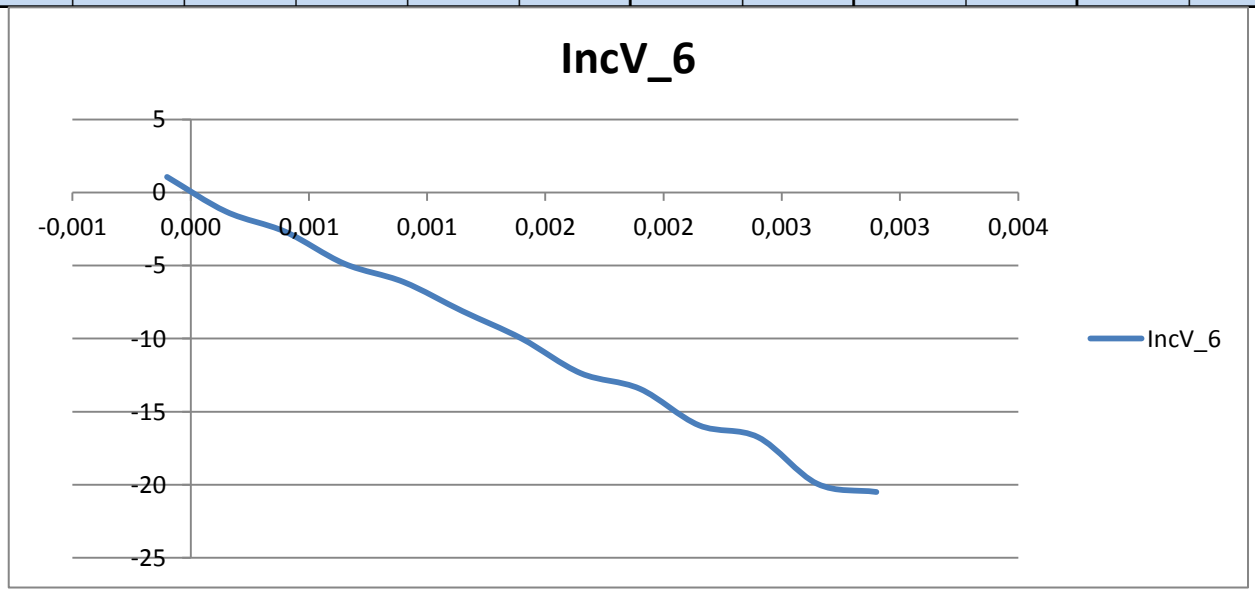
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_5	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.4375	0.1308125	14.15625	1.50869625	-0.3125	-0.0284375	89.6875	274.6875	89.3125	1034.5625	91.0625	260.375	90.8125	1020.5625
1	0.25	-0.5625	-0.0511875	12.90625	1.37400951	-0.1875	-0.0170625	89.1875	274	89.0625	1034.4375	88.6875	260.6875	88.4375	1021.9375
2	0.50	-2.75	-0.25025	12.71875	1.35393702	0.125	0.011375	88.6875	273.25	88.9375	1033.6875	86.0625	260.0625	86.0625	1021.4375
3	0.75	-4.9375	-0.4493125	13.4375	1.42874732	0.3125	0.0284375	88.6875	273.3125	88.4375	1035.3125	83.1875	260.0625	84.0625	1021.6875
4	1.00	-6.56410507	-0.59733356	14.5438739	1.54578788	0.25160507	0.02289606	88.3125	272.875	88.1875	1035.6875	81.3717899	259.037252	82	1020.4375
5	1.25	-8.0625	-0.7336875	13.28125	1.41486319	-0.125	-0.011375	87.4375	274.75	87.4375	1034.3125	79.5	260.6875	79.25	1021.8125
6	1.50	-9.8125	-0.8929375	14.03125	1.49181675	0.0625	0.0056875	86.8125	273.5	86.9375	1035.4375	77.0625	259.5625	77.0625	1021.3125
7	1.75	-12.4356447	-1.13164367	13.0491071	1.38971036	0.50185529	0.04566883	86.4962894	274.785714	87.25	1034.1875	74.3125	260.5625	74.5625	1022.3125
8	2	-13.8125	-1.2569375	12.375	1.31480659	-0.1875	-0.0170625	86.1875	272.8125	85.9375	1035.8125	72.3125	261.0625	72.1875	1022.8125
9	2.25	-16.25	-1.47875	14.0625	1.49434322	0.25	0.02275	86.1875	273.75	86.3125	1035.4375	69.8125	259.125	70.1875	1021.9375
10	2.5	-17.5625	-1.5981875	12.53125	1.33102568	-0.5625	-0.0511875	85.8125	272.125	84.9375	1035.3125	67.9375	260.1875	67.6875	1022.1875
11	2.75	-19.4375	-1.7688125	13.5	1.43339726	0.1875	0.0170625	85.3125	272.1875	84.9375	1036.3125	65.3125	259.9375	66.0625	1021.5625
12	3	-20.810779	-1.89378089	13.2991682	1.41494321	-0.12327898	-0.01121839	83.746558	273.535836	84	1035.1875	63.3125	260.5625	62.8125	1021.5625



Ensayo 6

TEST4 - TORNILLO5-6

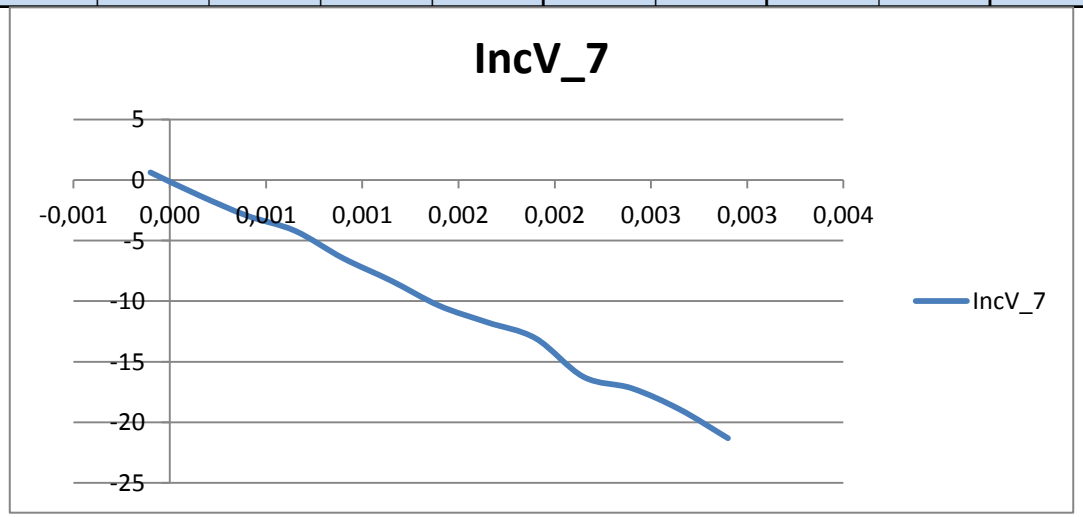
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_6	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.0625	0.0966875	15.3125	1.63065003	0.3125	0.0284375	89.5625	274.25	90.3125	1035.4375	91.0625	259.5	90.9375	1019.5625
1	0.25	-1.3125	-0.1194375	12.96875	1.38066297	-0.4375	-0.0398125	89.8125	273.3125	89.0625	1034.3125	88.1875	260.5	88.0625	1021.1875
2	0.50	-2.6875	-0.2445625	13.75	1.46089527	0.0625	0.0056875	88.4375	272.8125	88.9375	1035.0625	86.1875	258.9375	85.8125	1021.4375
3	0.75	-4.875	-0.443625	14.53125	1.54739401	-0.3125	-0.0284375	88.25	273.6875	88.25	1035.6875	83.6875	260.5	83.0625	1019.8125
4	1.00	-6.125	-0.557375	14.0625	1.49827531	-0.125	-0.011375	88.1875	273.5	87.8125	1034.5625	81.8125	260.25	81.9375	1019.6875
5	1.25	-8.125	-0.739375	14.03125	1.49328682	-0.4375	-0.0398125	87.5625	274.375	87.0625	1035.5625	79.375	260.4375	79	1021.4375
6	1.50	-10	-0.91	13.5625	1.4413292	0.6875	0.0625625	86.5625	273.8125	86.8125	1035.4375	76.125	259.6875	77.25	1022.4375
7	1.75	-12.3731447	-1.12595617	13.799156	1.46837985	0.25185529	0.02291883	86.4962894	273.785812	87.125	1034.5625	74.5	259.5625	74.375	1021.1875
8	2	-13.438684	-1.22292024	13.6064593	1.4474603	0.00118397	0.00010774	85.9375	273.875	86.1875	1035.8125	72.7476321	260.787081	72.5	1021.6875
9	2.25	-15.9367371	-1.45024308	13.2493897	1.40881524	-0.4345645	-0.03954537	86.3713016	272.78591	86.25	1035.3125	70.7478274	260.28713	70	1021.3125
10	2.5	-16.7509704	-1.5243383	13.4813922	1.43180509	-0.31152964	-0.0283492	84.9375	273.375	84.8125	1035.5625	68.3730593	259.412216	67.875	1022.5625
11	2.75	-19.9375	-1.8143125	14.46875	1.54099224	0.25	0.02275	84.9375	273.5	85.1875	1035.4375	65	260.4375	65.25	1019.5625
12	3	-20.5	-1.8655	12.75	1.35464889	-0.1875	-0.0170625	84.0625	272.6875	83.9375	1035.5625	63.625	260.4375	63.375	1022.3125



Ensayo 7

TEST4 - TORNILLO5-6

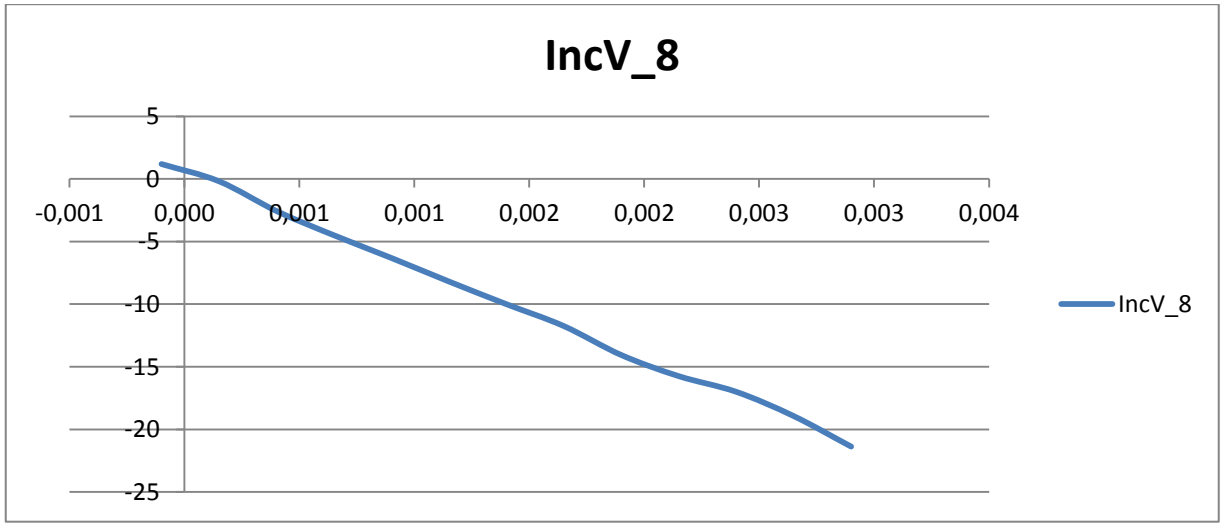
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_7	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	0.625	0.056875	14.09375	1.49981737	0	0	90.1875	273.5	90.0625	1035.5625	90.6875	260.3125	90.8125	1020.5625
1	0.25	-1.25	-0.11375	11.4375	1.21679567	-0.375	-0.034125	89.8125	272.625	89.0625	1033.5625	88.1875	260.75	88.1875	1022.5625
2	0.50	-2.9375	-0.2673125	12.78125	1.35970373	0.1875	0.0170625	88.6875	273.8125	89.0625	1033.4375	85.9375	259.25	85.9375	1022.4375
3	0.75	-4.1875	-0.3810625	12.03125	1.27854831	-0.3125	-0.0284375	88.5625	272.375	87.9375	1033.4375	84.0625	259.1875	84.0625	1022.5625
4	1.00	-6.45216222	-0.58714676	10.5871349	1.1262268	0.20408778	0.01857199	87.9355744	271.45552	88.21875	1033.65625	81.5625	261.625	81.6875	1022.3125
5	1.25	-8.31058979	-0.75626367	10.6117109	1.13022238	0.31441021	0.02861133	87.6211796	272.660922	88.375	1032.5625	79.75	261.4375	79.625	1022.5625
6	1.50	-10.375	-0.944125	11.90625	1.26567691	0.1875	0.0170625	87.3125	272.5	86.9375	1034.4375	76.375	260.5625	77.125	1022.5625
7	1.75	-11.7481447	-1.06908117	10.8617109	1.15495255	0.18935529	0.01723133	86.4962894	272.660922	87.25	1033.3125	75.3125	260.6875	74.9375	1023.5625
8	2	-13.0606447	-1.18851867	12.0491926	1.28132285	0.06435529	0.00585633	86.4962894	273.035885	86	1034.5625	72.875	260.8125	73.5	1022.6875
9	2.25	-16.25	-1.47875	11.34375	1.20538679	0.25	0.02275	86.1875	272.375	86.1875	1034.6875	69.6875	261.0625	70.1875	1023.3125
10	2.5	-17.1875	-1.5640625	11.59375	1.23296306	0.25	0.02275	85.1875	271.625	84.9375	1033.6875	67.5	260.4375	68.25	1021.6875
11	2.75	-18.9375	-1.7233125	10.40625	1.10713146	0.25	0.02275	85.0625	271.375	85.1875	1033.6875	66	261.9375	66.375	1022.3125
12	3	-21.3107485	-1.93927811	11.9242292	1.2676183	0.43925154	0.03997189	84.3714969	272.285958	85	1034.5625	63.25	260.6875	63.5	1022.3125



Ensayo 8

TEST4 - TORNILLO5-6

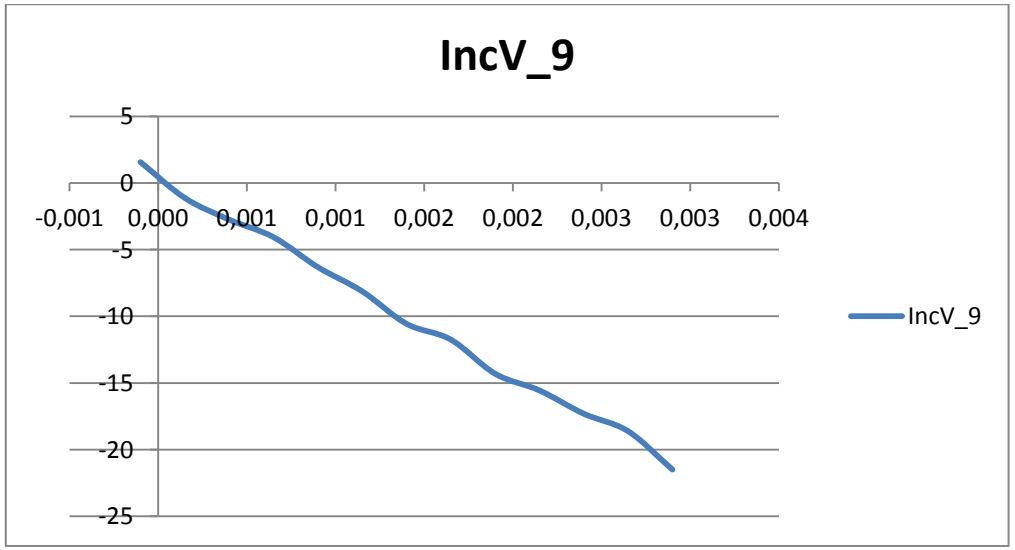
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_8	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.1875	0.1080625	12.5625	1.33669952	0.3125	0.0284375	89.4375	273.25	89.9375	1034.4375	90.8125	260.625	90.9375	1021.9375
1	0.25	-0.1875	-0.0170625	12.53125	1.33408684	-0.6875	-0.0625625	89.4375	272.5	88.6875	1033.8125	89.1875	260.4375	88.5625	1020.8125
2	0.50	-2.5625	-0.2331875	11.5625	1.22878269	0.0625	0.0056875	88.5625	271.8125	88.9375	1033.5625	86.3125	259.8125	86.0625	1022.4375
3	0.75	-4.5	-0.4095	11.625	1.23847156	-0.125	-0.011375	88.5625	272.625	88.0625	1032.4375	83.6875	260.5	83.9375	1021.3125
4	1.00	-6.3125	-0.5744375	11.96875	1.2742035	-0.0625	-0.0056875	88.0625	272.5625	88.0625	1034.1875	81.8125	261.375	81.6875	1021.4375
5	1.25	-8.18901352	-0.74520023	11.4189898	1.2162536	-0.12348648	-0.01123727	87.5625	272.5	87.5625	1033.3125	79.496973	261.41202	79.25	1021.5625
6	1.50	-10	-0.91	11.71875	1.24584765	0.6875	0.0625625	86.4375	272.125	87.0625	1033.5625	76.375	259.9375	77.125	1022.3125
7	1.75	-11.75	-1.06925	13.46875	1.43377784	0.375	0.034125	86.5625	273.625	87.1875	1033.5625	75.0625	259.1875	75.1875	1021.0625
8	2	-14.0625	-1.2796875	11.90625	1.26692718	-0.5	-0.0455	86.3125	272.125	86.0625	1034.5625	72.5	261.4375	71.75	1021.4375
9	2.25	-15.75	-1.43325	11.15625	1.18614506	-0.4375	-0.0398125	86.1875	272.25	86.0625	1033.3125	70.75	260.3125	70	1022.9375
10	2.5	-17	-1.547	11.625	1.23694595	0.125	0.011375	85.0625	272.6875	85.0625	1033.6875	67.9375	260.8125	68.1875	1022.3125
11	2.75	-18.9375	-1.7233125	11.46875	1.21767199	0.0625	0.0056875	84.9375	272.25	85.0625	1034.4375	66.0625	260.0625	66.0625	1023.6875
12	3	-21.375	-1.945125	11.59375	1.23377288	0.0625	0.0056875	84.5625	272.75	84.9375	1033.5625	63.5	260.8125	63.25	1022.3125



Ensayo 9

TEST4 - TORNILLO5-6

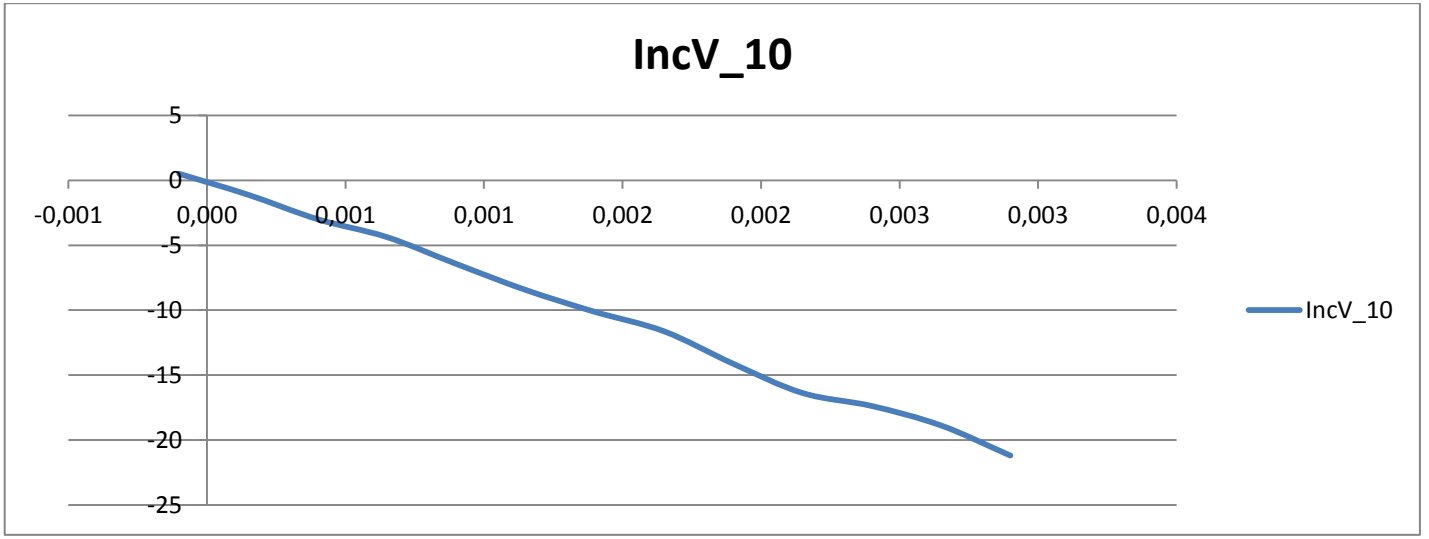
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_9	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	1.5625	0.1421875	12.84375	1.36746959	0.0625	0.0056875	89.4375	272.625	89.8125	1034.3125	91.3125	260.6875	91.0625	1020.5625
1	0.25	-1.125	-0.102375	12.0625	1.28455677	-0.625	-0.056875	89.6875	271.5	89.0625	1033.5625	88.5625	260.875	87.9375	1020.0625
2	0.50	-2.75	-0.25025	11.75	1.24952872	0.125	0.011375	88.8125	271.5	88.5625	1033.6875	85.6875	260.25	86.1875	1021.4375
3	0.75	-4.0625	-0.3696875	10.78125	1.14683914	0.3125	0.0284375	87.9375	271.875	88.1875	1032.5625	83.8125	260.3125	84.1875	1022.5625
4	1.00	-6.3125	-0.5744375	12.125	1.28856258	-0.1875	-0.0170625	88.1875	271.5	87.8125	1034.5625	81.6875	260.25	81.6875	1021.5625
5	1.25	-8.125	-0.739375	10.40625	1.10731189	0.25	0.02275	87.4375	271.625	87.8125	1033.3125	79.4375	261.6875	79.5625	1022.4375
6	1.50	-10.5625	-0.9611875	11.5	1.2235449	0.3125	0.0284375	87.1875	271.875	87.0625	1033.3125	76.1875	260.5	76.9375	1021.6875
7	1.75	-11.75	-1.06925	11.8125	1.25741281	1.0625	0.0966875	86.1875	272.3125	87.3125	1033.4375	74.5	260.6875	75.5	1021.4375
8	2	-14.3125	-1.3024375	11.84375	1.25996485	-0.875	-0.079625	87.0625	272.25	86.1875	1034.5625	72.75	261.3125	71.875	1021.8125
9	2.25	-15.5635863	-1.41628636	10.8252032	1.15059837	-0.12391368	-0.01127614	85.6875	272.3125	86.1875	1033.5625	70.7478274	260.662094	70	1023.5625
10	2.5	-17.3125	-1.5754375	10.65625	1.13391455	0.1875	0.0170625	85.0625	271.625	85.0625	1033.5625	67.5625	261.6875	67.9375	1022.1875
11	2.75	-18.625	-1.694875	11.1875	1.18932288	-0.1875	-0.0170625	84.6875	273.1875	84.9375	1033.9375	66.5	260.8125	65.875	1023.9375
12	3	-21.5	-1.9565	11.28125	1.19943399	0.125	0.011375	84.5625	272.125	85.0625	1033.8125	63.4375	260.6875	63.1875	1022.6875



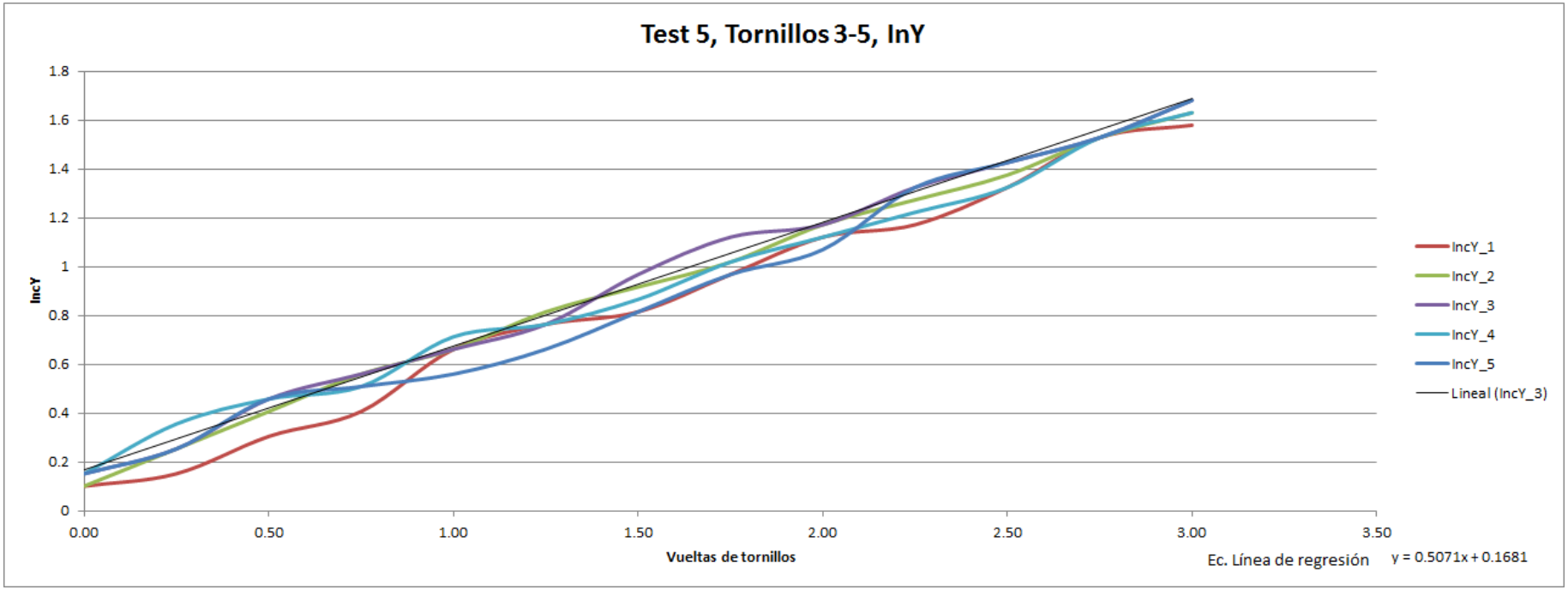
Ensayo 10

TEST4 - TORNILLO5-6

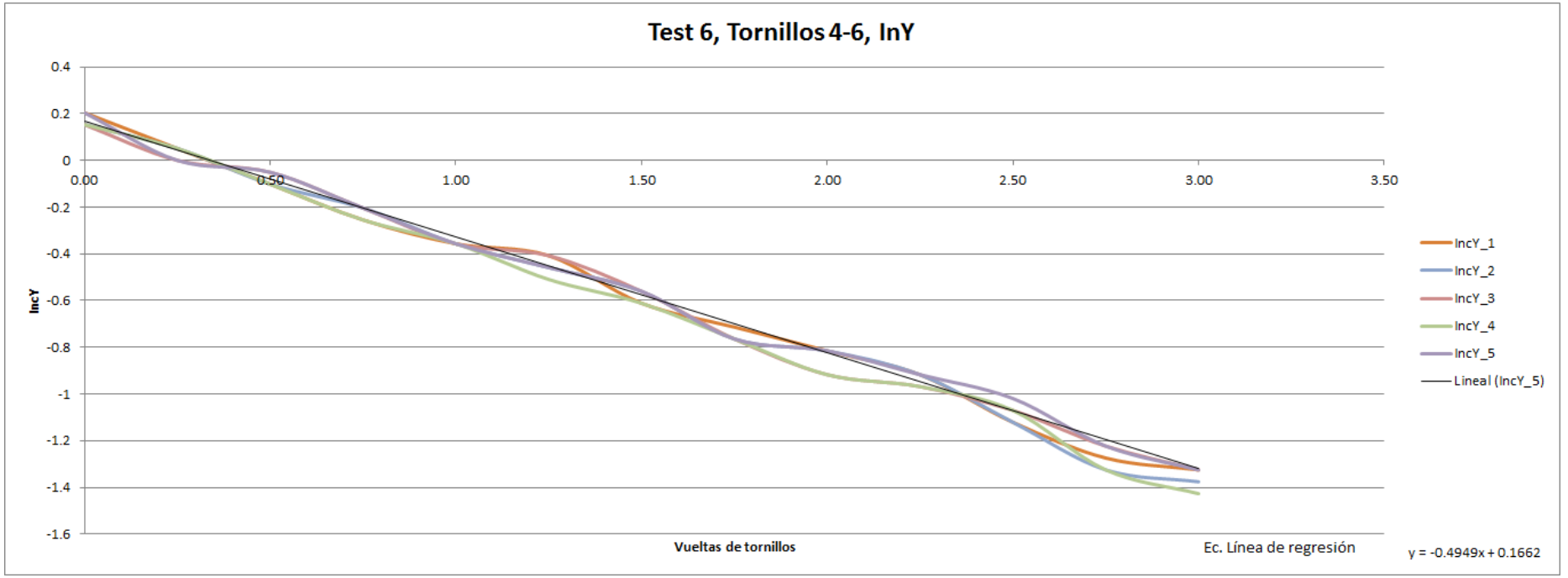
Carpetas	Vueltas	Incremetos						puntoA1		puntoB1		puntoA2		puntoB2	
		IncV_10	IncZ	IncU_1	IncX	IncVAB	IncZ_B	v	u	v	u	v	u	v	u
0	0.00	0.5	0.0455	12.03125	1.28106679	-0.875	-0.079625	90.3125	272.875	89.3125	1033.1875	90.6875	260.4375	89.9375	1021.5625
1	0.25	-1.125	-0.102375	12.375	1.3172901	-0.5	-0.0455	89.6875	272.25	88.9375	1033.6875	88.3125	260.375	88.0625	1020.8125
2	0.50	-3	-0.273	11.6875	1.24298416	-0.25	-0.02275	88.9375	272.75	88.9375	1033.9375	86.1875	260.625	85.6875	1022.6875
3	0.75	-4.375	-0.398125	11.53125	1.22631626	0	0	88.3125	271.6875	88.3125	1033.6875	83.9375	260.5	83.9375	1021.8125
4	1.00	-6.43911727	-0.58595967	11.8564288	1.26149796	0.00161727	0.00014717	88.5625	272	88.0625	1033.3125	81.6217655	260.162142	82.125	1021.4375
5	1.25	-8.4375	-0.7678125	11.46875	1.22187604	-0.375	-0.034125	87.8125	272.875	87.3125	1033.8125	79.25	262.0625	79	1021.6875
6	1.50	-10.1263671	-0.9214994	11.762691	1.24993418	0.18886705	0.0171869	87.3125	271.8125	86.8125	1034.4375	76.4972659	260.412118	77.375	1022.3125
7	1.75	-11.625	-1.057875	10.75	1.14346934	0.3125	0.0284375	86.4375	272.5625	86.8125	1032.9375	74.875	260.6875	75.125	1023.3125
8	2	-14.1261718	-1.28548163	11.8877398	1.2659211	-0.31132824	-0.02833087	86.8125	273.8125	86.3125	1033.9375	72.4976565	261.41202	72.375	1022.5625
9	2.25	-16.375	-1.490125	11.84375	1.25872345	-0.5	-0.0455	86.3125	272.75	86.1875	1034.5625	70.3125	260.5625	69.4375	1023.0625
10	2.5	-17.375	-1.581125	11.46875	1.22007127	-0.125	-0.011375	85.6875	272.875	85.3125	1033.4375	68.0625	260.5625	68.1875	1022.8125
11	2.75	-18.8732241	-1.71746339	11.0492658	1.17268039	0.25177595	0.02291161	84.8714481	271.536032	84.875	1034.6875	65.75	260.4375	66.25	1023.6875
12	3	-21.1857363	-1.927902	11.424217	1.21526252	-0.37323626	-0.0339645	84.6214725	272.535934	84.75	1033.1875	63.9375	260.3125	63.0625	1022.5625



1.5. Caracterización: Ensayo Rotación Y, Tornillo 3 y 5



1.6. Caracterización: Ensayo Rotación Y, Tornillo 4 y 6



2. Verificación

2.1. Ensayo tipo 1

TEST TIPO 1

Ensayo 1	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	0.83	0.15	1.0625	0.0966875	5.375	0.5710308	90.0625	272.5	89.9375	1035.5625	90.9375	267.75	91.1875	1029.5625
Iteración 1			-0.125	-0.011375	-1.0625	-0.11305446	89.3125	266.5	89.9375	1026.5625	89.4375	266.375	89.5625	1028.8125
Iteración 2			-0.3125	-0.0284375	2.125	0.2267602	89.4375	267.625	90.0625	1027.4375	89.4375	266.25	89.4375	1024.5625
Iteración 3			-0.375	-0.034125	-0.21875	-0.02329602	89.4375	267.625	89.9375	1026.8125	89.4375	266.4375	89.1875	1028.4375

Ensayo 2	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	0.81	0.14	1	0.091	5.34375	0.56782726	89.9375	272.5	90.4375	1035.4375	91.1875	267.8125	91.1875	1029.4375
Iteración 1			0.25	0.02275	-0.65625	-0.07017619	89.4375	267.5625	89.1875	1024.5625	89.3125	267.75	89.8125	1025.6875
Iteración 2			0.4375	0.0398125	0.875	0.09351807	89.5625	267.8125	89.6875	1025.4375	90.0625	266.6875	90.0625	1024.8125
Iteración 3			-0.1875	-0.0170625	0.625	0.06673809	89.5625	267.5	89.3125	1025.6875	89.3125	266.5	89.1875	1025.4375

Ensayo 3	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	0.83	0.9	1.0625	0.0966875	5.84375	0.62070267	89.8125	272.5625	90.3125	1035.6875	91.1875	267.25	91.0625	1029.3125
Iteración 1			0.9375	0.0853125	5.375	0.57093695	90.0625	272.5	90.0625	1035.4375	90.9375	267.5	91.0625	1029.6875
Iteración 2			0.375	0.034125	0.875	0.09347952	89.4375	267.5	89.8125	1025.6875	89.9375	266.625	90.0625	1024.8125
Iteración 3			-0.1875	-0.0170625	0.625	0.06673809	89.5625	267.5	89.3125	1025.6875	89.3125	266.5	89.1875	1025.4375

Ensayo 4	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	0.83	0.32	1	0.091	2.0625	0.22007288	89.6875	272.625	90.1875	1030.6875	90.6875	269.5	91.1875	1029.6875
Iteración 1			0.375	0.034125	1.9375	0.20588718	89.4375	270.375	90.0625	1032.5625	90.3125	268.375	89.9375	1030.6875
Iteración 2			-0.0625	-0.0056875	0.0625	0.00666118	89.9375	268.625	89.8125	1028.5625	89.8125	268.5	89.8125	1028.5625

Ensayo 5	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	0.1	0.32	0.6875	0.0625625	2.0625	0.22012725	89.8125	272.6875	90.1875	1030.5625	90.4375	269.5625	90.9375	1029.5625
Iteración 1			0.5625	0.0511875	0.21875	0.02330937	89.3125	267.5	89.3125	1026.9375	89.8125	266.5625	89.9375	1027.4375
Iteración 2			0	0	1	0.10671937	89.4375	267.3125	89.0625	1026.4375	89.3125	266.4375	89.1875	1025.3125
Iteración 3			0	0	0.125	0.01333882	89.6875	266.375	88.9375	1025.6875	89.5625	266.5	89.0625	1025.3125

TEST TIPO 1

Ensayo 1	Punto A vs Punto B			Valores en coordenadas globales (MTP)									PROMEDIO			Imagen vs Real	
	IncU1	IncU2	promedio	X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	4.75	6	5.375	Punto A						Punto A			-0.0117	0.0125	-0.03505	-0.011596024	0.000925
Iteración 1	0.125	-2.25	-1.0625	23.1258	22.9905	-1.998	-1.998	-3.989	-3.9904	0.1353	0	0.0014					
Iteración 2	1.375	2.875	2.125	Punto B						Punto B							
Iteración 3	1.1875	-1.625	-0.21875	97.9853	98.144	-1.9874	-2.0124	-3.2966	-3.2251	-0.1587	0.025	-0.0715					

Ensayo 2				Valores en coordenadas globales									PROMEDIO			Imagen vs Real	
				X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	4.6875	6	5.34375	A						Punto A			0.06165	0.00615	-0.01655	0.00508809	0.0005125
Iteración 1	-0.1875	-1.125	-0.65625	23.1134	23.0151	-1.9939	-2.0021	-4.0006	-3.9787	0.0983	0.0082	-0.0219					
Iteración 2	1.125	0.625	0.875	B						Punto B							
Iteración 3	1	0.25	0.625	97.8727	97.8477	-2.0079	-2.012	-3.2403	-3.2291	0.025	0.0041	-0.0112					

Ensayo 3				Valores en coordenadas globales									PROMEDIO			Imagen vs Real	
				X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	5.3125	6.375	5.84375	A						Punto A			0.06165	0.00615	-0.01655	0.00508809	0.0005125
Iteración 1	5	5.75	5.375	23.1134	23.0151	-1.9939	-2.0021	-4.0006	-3.9787	0.0983	0.0082	-0.0219					
Iteración 2	0.875	0.875	0.875	B						Punto B							
Iteración 3	1	0.25	0.625	97.8727	97.8477	-2.0079	-2.012	-3.2403	-3.2291	0.025	0.0041	-0.0112					

Ensayo 4				Valores en coordenadas globales									PROMEDIO			Imagen vs Real	
				X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	3.125	1	2.0625	A						Punto A			0	0	0	0.006661184	0.0056875
Iteración 1	2	1.875	1.9375	23.2239	23.2117	-1.9817	-1.9858	-4.0338	-4.0225	0.0122	0.0041	-0.0113					
	0	0	0	B						Punto B							
Iteración 2	0.125	0	0.0625	23.2117	23.2239	-1.9858	-1.9817	-4.0225	-4.0338	-0.0122	-0.0041	0.0113					

Ensayo 5				Valores en coordenadas globales									PROMEDIO			Imagen vs Real	
				X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	3.125	1	2.0625	A						Punto A			0.0135	0.0112	-0.0314	-0.000161176	0.0314
Iteración 1	0.9375	-0.5	0.21875	23.0028	23.015	-2.0001	-1.9939	-3.9845	-4.0016	-0.0122	-0.0062	0.0171					
Iteración 2	0.875	1.125	1	B						Punto B							
Iteración 3	-0.125	0.375	0.125	97.8718	97.8326	-2.0202	-2.0488	-3.206	-3.1261	0.0392	0.0286	-0.0799					

2.2. Ensayo tipo 2

TEST TIPO 2

Ensayo 1	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	0.85	0.13	0.9375	0.0853125	5.53125	0.58828151	87.6875	264.375	80.9375	1026.5625	88.4375	259.4375	82.0625	1020.4375
Iteración 1			-0.125	-0.011375	1.46875	0.15619755	87.5625	258.375	81.5625	1020.6875	87.8125	257.5625	81.0625	1018.5625
Iteración 2			-0.06058979	-0.00551367	1.14365052	0.121862	87.6211796	258.537301	81	1018.8125	87.4375	257.5	81.0625	1017.5625
Iteración 3			-0.0625	-0.0056875	0.59375	0.06330991	87.5625	258.5	81.0625	1017.6875	87.5	257.4375	81	1017.5625

Ensayo 2	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	1.55	-0.1	-0.4375	-0.0398125	10.125	1.07601476	88.3125	261.5	81.3125	1023.6875	87.8125	251.375	80.9375	1013.5625
Iteración 1			0.4375	0.0398125	0.5625	0.05991126	88.3125	249.625	80.9375	1010.5625	88.4375	249.5	81.6875	1009.5625
Iteración 2			0.125	0.011375	0.5625	0.05983258	87.6875	249.625	81.3125	1011.4375	88.1875	249.375	81.0625	1010.5625
Iteración 3			0.3125	0.0284375	-0.34375	-0.03655987	87.3125	248.5	81.0625	1010.6875	87.8125	249.4375	81.1875	1010.4375

Ensayo 3	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	1.8	0.03	0.25192852	0.0229255	11.7372968	1.24825946	87.996143	260.662094	82	1022.8125	88.5	249.4375	82	1010.5625
Iteración 1			-0.0625	-0.0056875	0.96875	0.1030917	88.0625	246.5	81.3125	1008.6875	87.9375	246.5625	81.3125	1006.6875
Iteración 2			0.625	0.056875	-0.4375	-0.04665515	87.8125	246.4375	81.1875	1005.6875	88.0625	246.5625	82.1875	1006.4375
Iteración 3			0	0	0.90625	0.09654368	87.5625	246.25	81.6875	1005.5625	87.8125	244.3125	81.4375	1005.6875

Ensayo 4	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	1.9	0.07	0.5	0.0455	12.0625	1.28413262	88.1875	261.625	81.8125	1021.4375	88.9375	248.5	82.0625	1010.4375
Iteración 1			-0.25	-0.02275	-0.75	-0.07986199	87.8125	245.375	81.5625	1005.6875	87.9375	245.75	80.9375	1006.8125
Iteración 2			0.125	0.011375	-0.28125	-0.02995204	87.6875	246.5625	81.0625	1005.6875	87.9375	245.375	81.0625	1007.4375

Ensayo 5	Vueltas tornillo/s		Incrementos				Punto A1		Punto A2		Punto B1		Punto B2	
	Torn1	Torn5-6	IncV	IncZ	IncU	IncX	v	u	v	u	v	u	v	u
Inicial	2.1	0.07	0.5625	0.0511875	13.6875	1.45736636	87.8125	259.5	81.6875	1018.8125	88.9375	244.375	81.6875	1006.5625
Iteración 1			0	0	-0.03125	-0.00333102	87.9375	243.5	81.0625	1001.5625	87.9375	241.6875	81.0625	1003.4375

TEST TIPO 2

Ensayo 1	Punto A vs Punto B			Valores en coordenadas globales (MTP)									PROMEDIO			Imagen vs Real	
	IncU1	IncU2	promedio	X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	4.9375	6.125	5.53125	Punto A						Punto A			0.0585	-0.020585	-0.00515	0.004809909	0.0005375
Iteración 1	0.8125	2.125	1.46875	22.229	22.1245	-2.0593	-2.01613	-3.8262	-3.8215	0.1045	-0.04317	-0.0047					
Iteración 2	1.03730104	1.25	1.14365052	Punto B						Punto B							
Iteración 3	1.0625	0.125	0.59375	97.0626	97.0501	-2.2781	-2.2801	-2.492	-2.4864	0.0125	0.002	-0.0056					

Ensayo 2	Punto A vs Punto B			Valores en coordenadas globales (MTP)									PROMEDIO			Imagen vs Real	
	IncU1	IncU2	promedio	X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	10.125	10.125	10.125	A						Punto A			-0.03375	-0.01025	0.02825	-0.002809868	0.0001875
Iteración 1	0.125	1	0.5625	21.2451	21.337	-2.0674	-2.051	-3.8131	-3.8579	-0.0919	-0.0164	0.0448					
Iteración 2	0.25	0.875	0.5625	B						Punto B							
Iteración 3	-0.9375	0.25	-0.34375	96.3714	96.347	-2.278	-2.2739	-2.4988	-2.5105	0.0244	-0.0041	0.0117					

Ensayo 3	Punto A vs Punto B			Valores en coordenadas globales (MTP)									PROMEDIO			Imagen vs Real	
	IncU1	IncU2	promedio	X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	11.2245935	12.25	11.7372968	A						Punto A			0.08955	0	0.00085	0.006993682	0.00085
Iteración 1	-0.0625	2	0.96875	21.0235	20.8326	-2.0592	-2.051	-3.8381	-3.8629	0.1909	-0.0082	0.0248					
Iteración 2	-0.125	-0.75	-0.4375	B						Punto B							
Iteración 3	1.9375	-0.125	0.90625	95.8668	95.8786	-2.2575	-2.2657	-2.5611	-2.538	-0.0118	0.0082	-0.0231					

Ensayo 4	Punto A vs Punto B			Valores en coordenadas globales (MTP)									PROMEDIO			Imagen vs Real	
	IncU1	IncU2	promedio	X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	13.125	11	12.0625	A						Punto A			-0.02785	-0.0041	0.01115	-0.002102041	0.000225
Iteración 1	-0.375	-1.125	-0.75	21.0542	20.9371	-2.0551	-2.0469	-3.8493	-3.8733	0.1171	-0.0082	0.024					
Iteración 2	1.1875	-1.75	-0.28125	95.8777	96.0505	-2.278	-2.278	-2.5037	-2.502	-0.1728	0	-0.0017					

Ensayo 5	Punto A vs Punto B			Valores en coordenadas globales (MTP)									PROMEDIO			Imagen vs Real	
	IncU1	IncU2	promedio	X		Y		Z		Δx	Δy	Δz	IncX	IncY	IncZ	InX	InZ
Inicial	15.125	12.25	13.6875	A						Punto A			-0.0031	0	0	-0.000231023	0
Iteración 1	1.8125	-1.875	-0.03125	95.4704	95.655	-2.2779	-2.2779	-2.5077	-2.5059	-0.1846	0	-0.0018					