Human influence over the setup presetting operations in CNC machines

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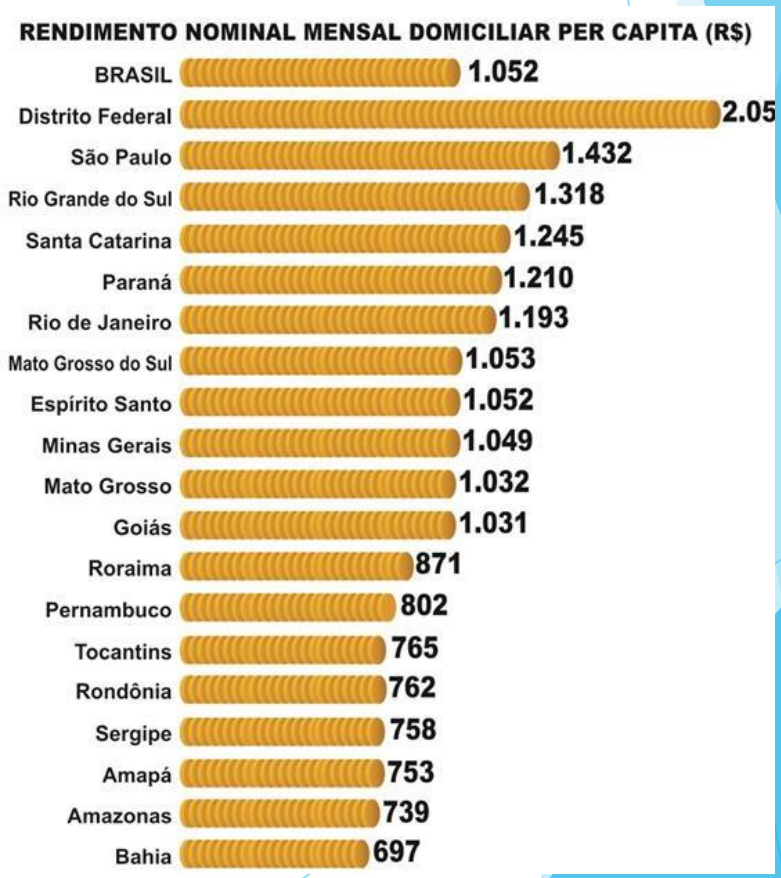
Sumary

- About Brazil
- Presentation of ABEPRO
- Presentation of Universidade Nove de Julho
- Human influences on presetting operations

About Brazil

- More than 200 million inhabitants

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EQUADOR
Boa Vista
RORAIMA
Serra Paacaraima
AMAPÁ
Macapá
Manaus
Belém
São Luís
Fortaleza
Fernando de Noronha (PE)
AMAZONAS
PARÁ
MARANHÃO
CEARÁ
RIO GRANDE DO NORTE
Teresina
Natal
PIAUÍ
PARAÍBA
João Pessoa
PERNAMBUCO
Recife
ACRE
Porto Velho
Rio Branco
Palmas
ALAGOAS
Maceió
RONDÔNIA
TOCANTINS
SERGIPE
Aracajú
10°
MATO GROSSO
BAHIA
Salvador
Cuiabá
BRASÍLIA-DF
GOIAS
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MINAS GERAIS
MATO GROSSO DO SUL
Belo Horizonte
ESPÍRITO SANTO
Campo Grande
SÃO PAULO
Vitória
20°
RIO DE JANEIRO
Rio de Janeiro
TRÓPICO DE CAPRICÓRNIO
PARANÁ
São Paulo
Curitiba
SANTA CATARINA
Florianópolis
RIO GRANDE DO SUL
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MATO GROSSO DO SUL
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S.J. dos Dourados
Barretos
Pereira Barreto
São José do Rio Preto
21°
Pardo
Aguapeí
Araçatuba
Ribeirão Preto
MINAS GERAIS
Araraquara
Mogi-Guaçu
Paraná
do Peixe
Bauru
Tietê
Presidente Prudente
Pedra da Mina
2.770 m
RJ
Piracicaba
Ourinhos
Piracicaba
Campinas
SERRA DA BOCAINA
São José dos Campos
Paraíba do Sul
Aranapanema
23°
Sorocaba
Osasco
Guarulhos
Trópico de Capricórnio
São Paulo
Santo André
PARANÁ
São Sebastião
Santos
Ilha de São Sebastião
OCEANO ATLÂNTICO
ESCALA
Portos principais
Patrimônio natural
Parque nacional
Usinas hidrelétricas
51°
49°
Ilha Comprida
Ilha do Cardoso
0
117 km

UNINOVE

ABEPRO
ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA DE PRODUÇÃO

AIM

ABEPRO
ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA DE PRODUÇÃO

Brazilian Association of Industrial Engineering

Regardind to ABEPRO

- Association / Institution that represents Industrial Engineering community in Brazil
  - Professors
  - Researchers
  - Students
  - Professionals
  - Higher Education Institutions
- Founded in 1986

ABEPRO's actions

- Diffusion of the role of Industrial Engineer to the society and industry
- Represents Industrial Engineering community at government institutions
  - CAPES
  - CNPQ
  - MEC/INEP
  - CONFEA/CREA
  - SBPC (Brazilian Society for the Progress of Science)
  - Other non governmental organizations interested on teaching of IE and on research on IE

ABEPRO's Events

ENCEP

- National Meeting of Coordinators of Industrial Engineering Courses (Encontro Nacional de Coordenadores de Cursos de Engenharia de Produção -ENCEP)
- Main event for the Coordinators of Industrial Engineering Courses, including under graduating and post graduating.
- Aims planning of teaching activities and research activities
- Main discussion forum of issues related to Industrial Engineering development. Promotes integration among the Higher Education Institutions offering Industrial Engineering Courses.
- www.abepro.org.br/encep

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AIM

ICIEOM

- International Conference on Industrial Engineering and Operations Management (ICIEOM)
  - The international event promoted by ABEPRO
  - Up to 2011 it was held in Brazil
  - From 2012 it is happening in Europe (Portugal and Spain), organized in cooperation with ABEPRO, ADINGOR, University of Minho and University of Aveiro
  - In 2014 the IIE (Institute of Industrial Engineers - USA) joined for the organization
  - 2016: AIM !!!
- www.icieom.org

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ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA DE PRODUÇÃO

AIM

- National Meeting of Industrial Engineering (Encontro Nacional de Engenharia de Produção - ENEGEP)
- Is the biggest event of Industrial Engineering held in Brazil
- Meeting of the academic (researchers, professors, students) and professional communities (consultants, managers, engineers and others) of Industrial Engineering
- Forum for diffusion of knowledge and technology related to IE
- Promotes integration among academic and productive sectors
- www.abepro.org.br/enegep

ABEPRO's Editorial Nucleous (NEA)

- Is the responsible for the execution of management, publication and distribution of journals, books and other publications from ABEPRO
- Books
  - ABEPRO has a collection of didactic books published in association with a publishing group from Brazil (Ed. Atlas)
- Journals
  - Production
    - www.prod.org.br
  - Produção Online
    - www.producaoonline.org.br
  - Brazilian Journal of Industrial Engineering & Operations Management
    - www.abepro.org.br/bjopm

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TESTE ABEPRO

- ABEPRO's Examination (Teste ABEPRO)
- Created from a demand from the community
- National examination for the admission process of post graduation programs in Industrial Engineering
- www.abepro.org.br/testeabepro



Universidade Nove de Julho
UNINOVE

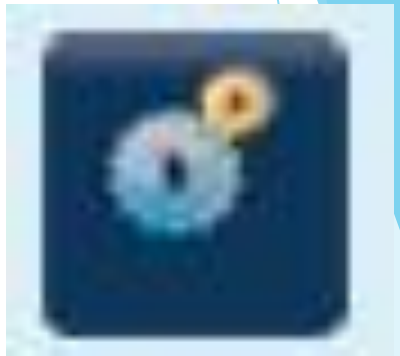

UNINOVE

- Rector: Prof. Eduardo Storópoli
- Started on 1952 with a typing school that became a High School on 1966
- On 1972 the first undergraduating course was created and on 1992 became Faculdades Integradas Nove de Julho (joint colleges)
- On 2008 became Universidade Nove de Julho

UNINOVE

- 5 Campi located at São Paulo - SP
- 4 Poles for Distance Learning located in the inner of São Paulo State
- More than 130 thousands students
- More than 200 under graduating courses
- 14 Post graduation programs on different areas

Industrial Engineering Post Graduation Program



- Research area
  - Management and Optimization of Production Systems
- Research lines
  - Production Management (6 professors)
  - Quantitative Methods and Quality Principles for the Optimization of Production Systems (5 professors)

Human influence over the setup presetting operations in CNC machines

Presetting Operations

- To ensure a precise machining, CNC system must know the dimensions (at least diameter, length) of the tools to be used on the machining process
- Presetting operations are reponsible for these information

Manual Presetting

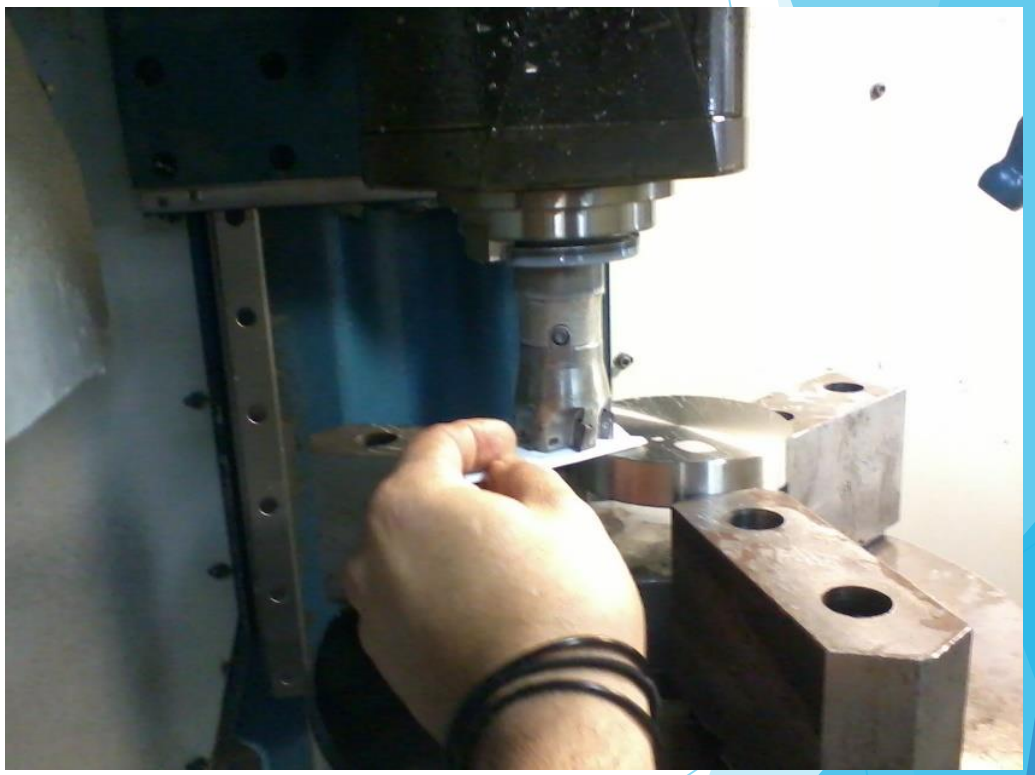
- Choose the tools
- Set tools on the magazine of machine tool
- Choose a tool to set the surface of reference on the part to be machined (zero part)
- Manually, move each tool to the surface of reference to set its dimensions
- Insert manually the dimensions of each tool on the CNC page

Aproximate time for the presetting of each tool:

3 minutes or more

Manual Presetting

- 50% a 75% of the tool change time refer to the manual presetting;
- Slow process;
- Compromises productivity and quality;
- Possibility of human error during the insertion of the measured data (diameter and length of tools);
- Imprecise measurements.



Detail of a manual measurement

Setup optimization – existing technology

- **Available systems can be external (presetters) or external (toolsetters) :**
  - **Presetters (external)**

  - **Tool-Setters (internal);**

Presetters

- Choose tools
- Position each tool on the device of the equipment
- Measure the toll dimensions
- Tranfer the tool dimensions to the CNC machine control (sometimes it is done manually)

Aproximate time for the presetting of each tool : 20 s to 30 s (except insertion of data)

Tool-setters

- Choose the tools
- Set tools on the magazine of machine tool
- Start the routine of automatic presetting
- Automatic detection of tools measurements and automatic storage of these data on the CNC command

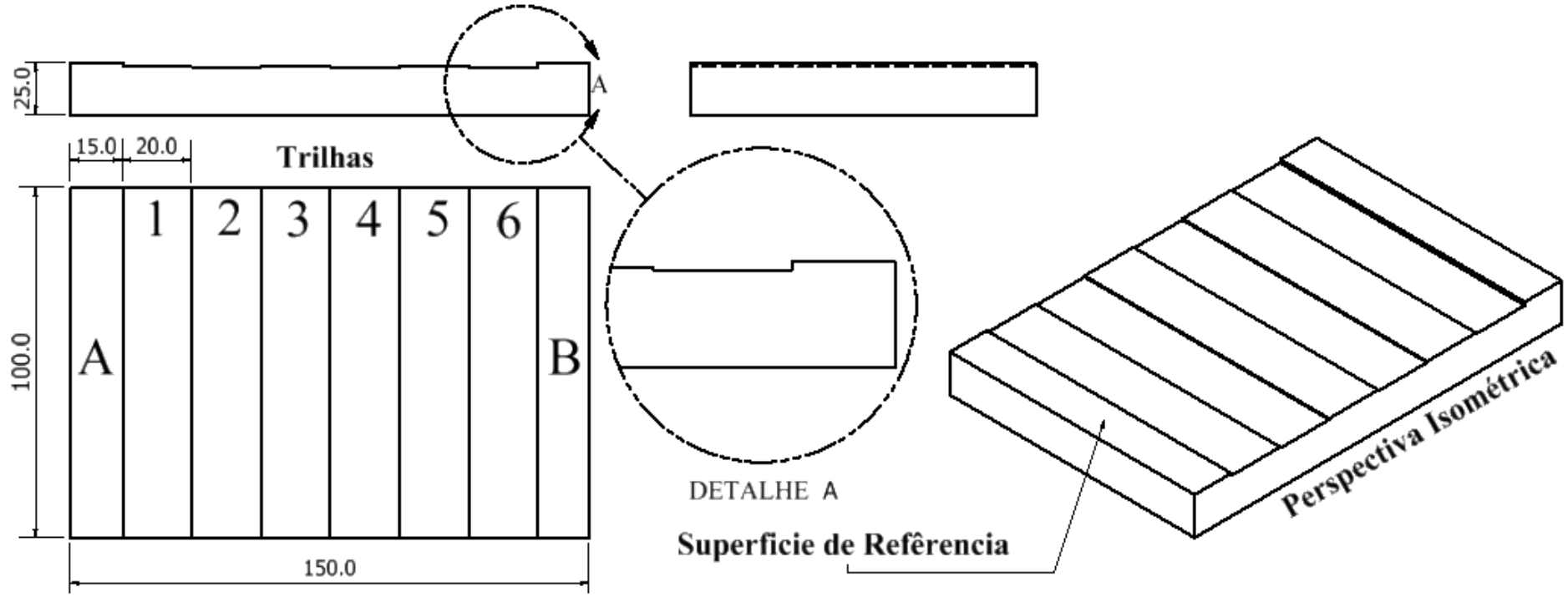
Aproximate time for the presetting of each tool : 30 s (including insertion of data)


GEO Tecno
TSG-130
TSG
Sistema Automático de Medição de Ferramentas a Laser

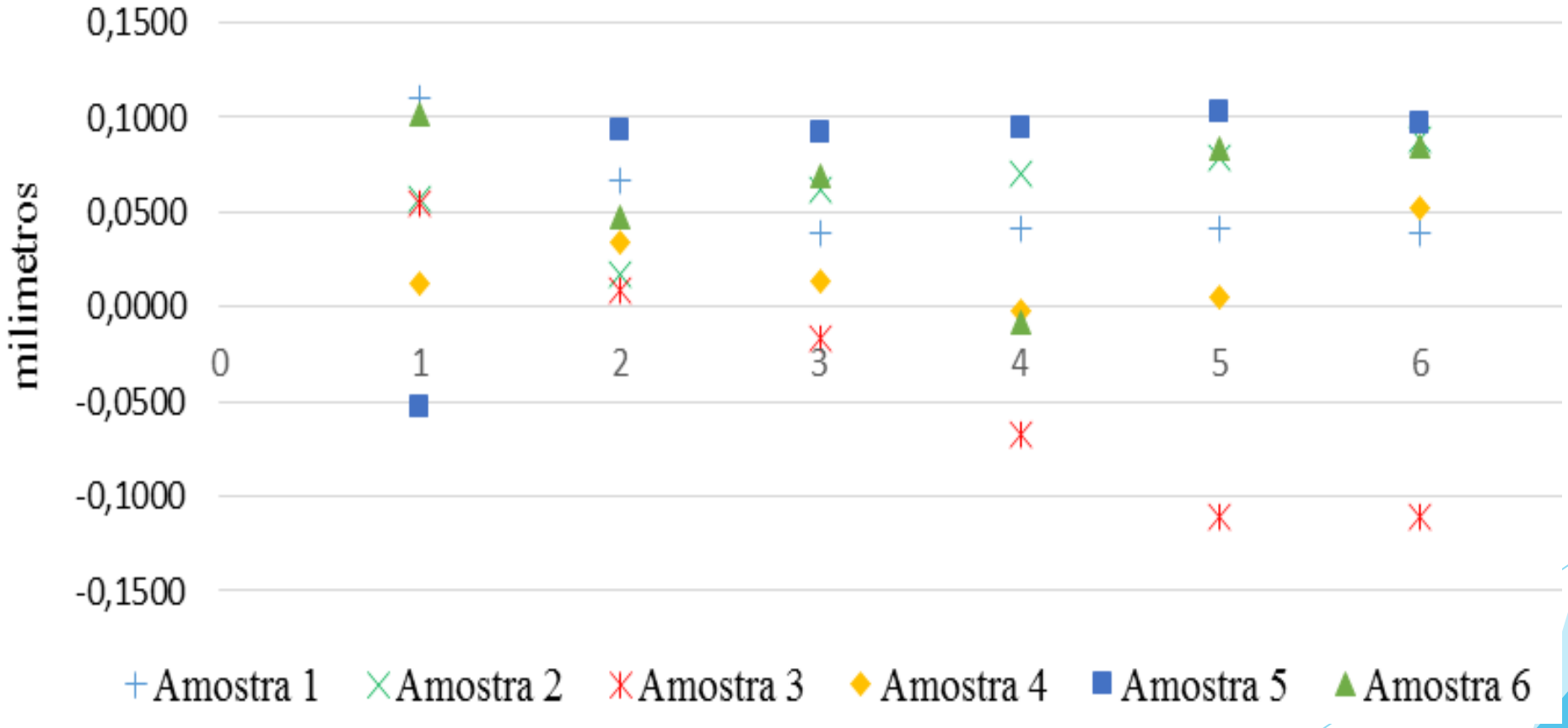
Human Influence on manual presetting

- Sensibility of operator can vary
- Pressure over the tool can damage it
- Insertion of data can bring some mistaken information
- Need to make some mathematical operations (sum or subtraction)

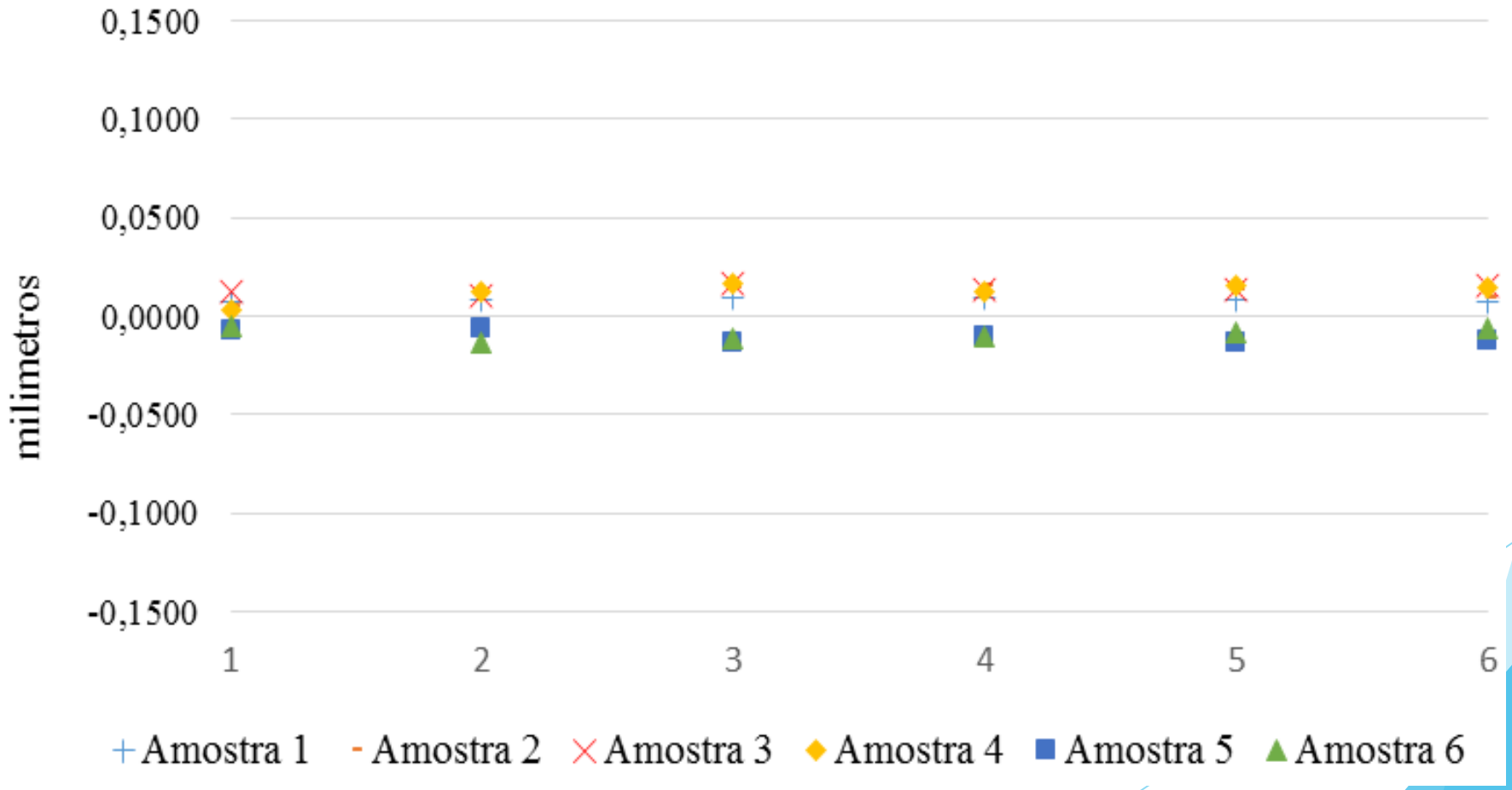
Influence Over the Quality of Machined Parts (Manual Method)



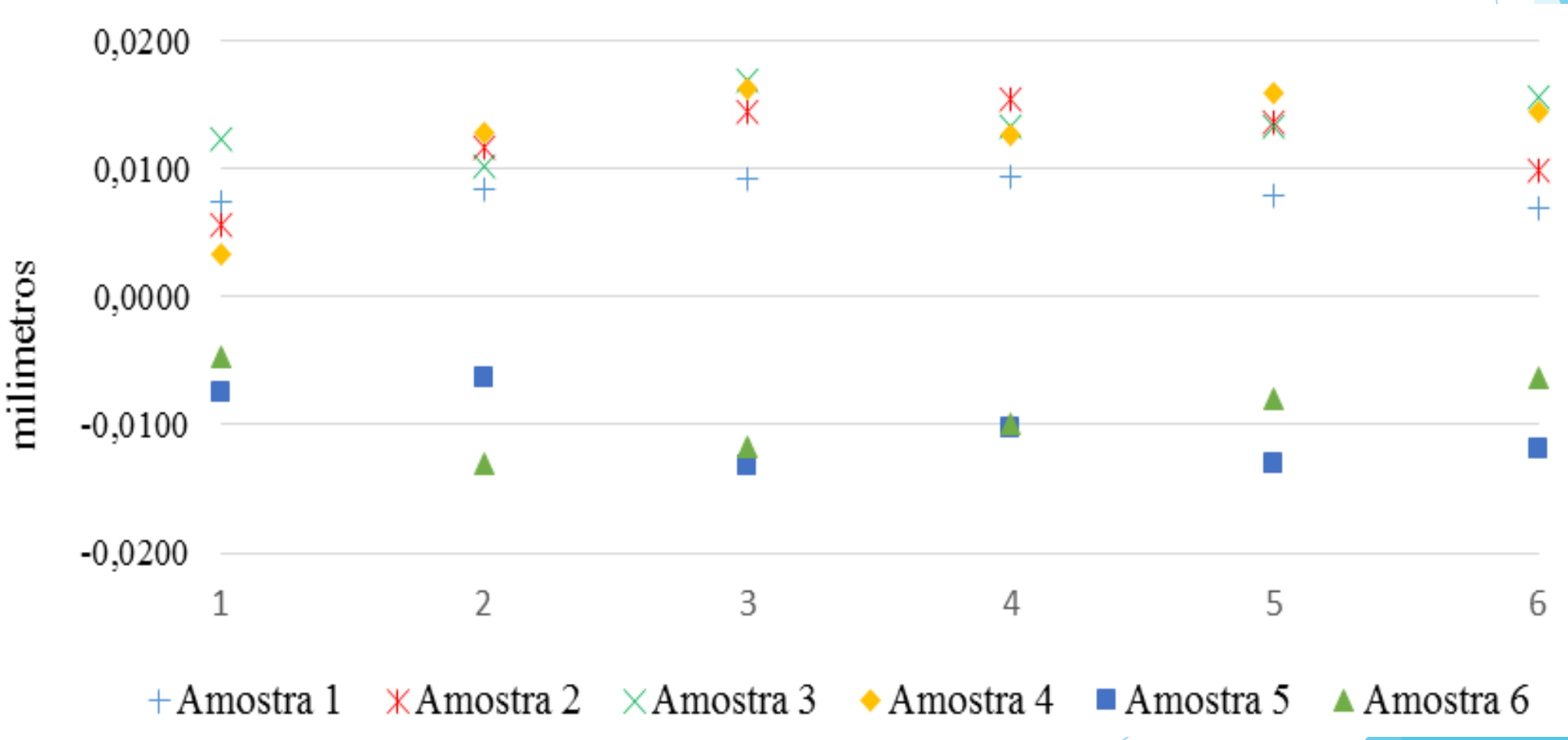
Influence Over the Quality of Machined Parts (Manual Method)



Influence Over the Quality of Machined Parts (with Toolsetter)



Influence Over the Quality of Machined Parts (with Toolsetter)



Influence Over Production Time

Operation	*Time (h) Manual method*	*Time (h) Toolsetter laser*
Tool sharpening (1 tool)	**00:04:48**	**00:04:48**
Machining cycle time	**00:00:35**	**00:00:35**
Tool measurement	**00:01:42**	**00:00:39**
Correction of measurements (fine adjust)	**00:01:05**	**-**
Total time	**00:08:10**	**00:06:02**

Considering 1 CNC machine, 6 tools and 4 changes of batches

(1working turn with 8 hours per day, 22 days a month, cost of machining: R$ 100,00/hour)

Tool measurement (Manual method)		Tool measurement (*Toolsetter*)	
Time expended on Preseting	4 min.	*Time expended on Preseting*	40 s
Total time (Hours)	176,0	Total time (Hours)	176,0
Productive time (Hours)	140,8	Productive time (Hours)	170,1
Non productive time (Hours)	35,20	Non productive time (Hours)	5,87
Utilization rate	80%	Utilization rate	97%
Waste (R$)	3520,00	Waste (R$)	586,64
Equivalent CNC machines non used	0,200 (20%)	Equivalent CNC machines non used	0,033 (3%)
On 12 months (R$)	42.240,00	On 12 months (R$)	7.039,68

Existing Technology for presetting: main advantages

- Presetting and setup time reduction
- More precise measurements
- Reduction of human error possibility due to the reduction of human interference

Issues to be considered for the use of Toolsetters

- Training and knowledge difusion for using the toolsetter
- Development of friendly programmable routines

Closing Remarks

- Human influence can result in errors of measurament of tools in presetting operations in CNC machines
- The use of Toolsetters can reduce those errors
- The programmable routines should be friendly for the worker