

MEASUREMENT TOOLS AND TECHNIQUES FOR ENERGY AND RESOURCE EFFICIENCY AND EFFECTIVENESS IN MANUFACTURING PROCESS CHAINS



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Current status:

- PhD Researcher, Trinity College Dublin
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Energy Resource Efficiency and Effectiveness

Project Aim:

- Measurement of energy consumption and subsequent adaptive control of machine tools in manufacturing process chains, in order to optimise energy and resource efficiency.

Subsequent Goals:

- Creating visibility of energy and resource consumption within a manufacturing process chain
- Connecting these readings with their associated process operations
- Establishing energy cost per unit product (establishing energy metric), utilising this energy metric to define optimisation
- Identification of Key Performance Indicators (KPI)
- Establishing adaptive control mechanisms for increased resource optimisation

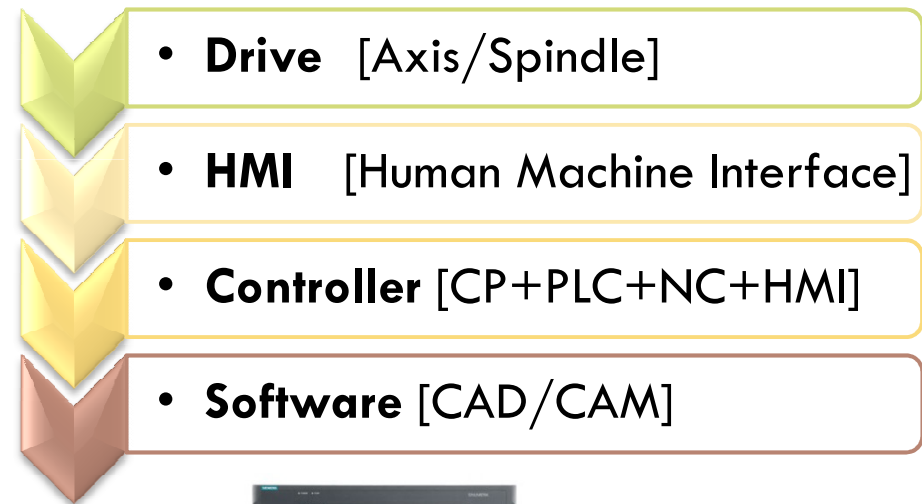
Manufacturing Process Chains - CNC Machining

SIEMENS SINUMERIK Solution Line CNC Controller

Overview:

- Modularised Components
 - Easily interconnected
- Multiple CNC Machine Orientations
 - 3 to 5 axis machining
 - Multiple Functionality / Control Mechanisms (hardware/ software)
- Cutting Edge Technology
 - High speed communication
 - Low – High complex part creation
- Open Architecture
 - Customisable Integral Software
 - Open machine structure and operation

Components:



SIEMENS
SINUMERIK
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Measurement Tools and Techniques

Data Acquisition:

- Ethernet TCP/IP, PROFIBUS, Message Passing Interface (MPI),
- Object Linking and Embedding Process Control (OPC)
- Siemens based technology, SINUCOM, Ctrl Energy, HMI programming package, ePS Network Services

Analysis and Adaptive Control:

- Neural Networks
 - *Artificial intelligence, for process input and output patterning.*
- Fuzzy Logic
 - *Utilises a set of logical rules, identifying an inputs degree of membership, to determine outputs*

Data Management / Communication:

- MTconnect (Open Standard)
 - *Agent based data Acquisition, Communication, and Analysis*
 - *eXtensible Markup Language (XML) message encoding*
- Application Programming Interface (API)



Project Progress

Progress:

- ❑ Research Paper Review:
 - Process monitoring
 - Energy monitoring
 - CNC Technology
 - CNC Adaptive control
 - MTconnect, etc..

- ❑ SINUMERIK Solution Line Review (Hardware / Software):
 - Commissioning Manuals
 - Programming Manuals
 - Function Manuals
 - Operating Manuals
 - Brochures, etc..

Current Plans:

- ❑ Research Paper Creation:
“SIEMENS SINUMERIK Solution Line CNC Technology”

Benefits:

- Introduces Siemens CNC technology in a structured informative manner
- Provide an overview of all key components for both hardware and software
- Outlines structural orientations and functionalities. (Hardware, Software, and Communication)