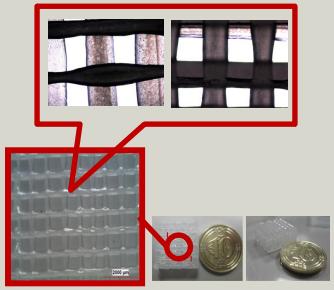
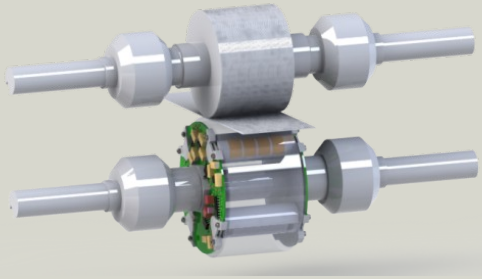
Bio-printing

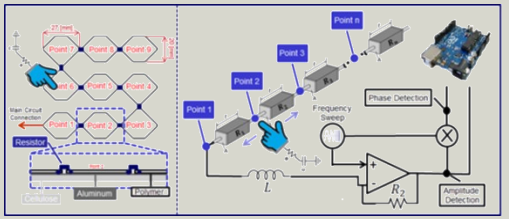


Simulations

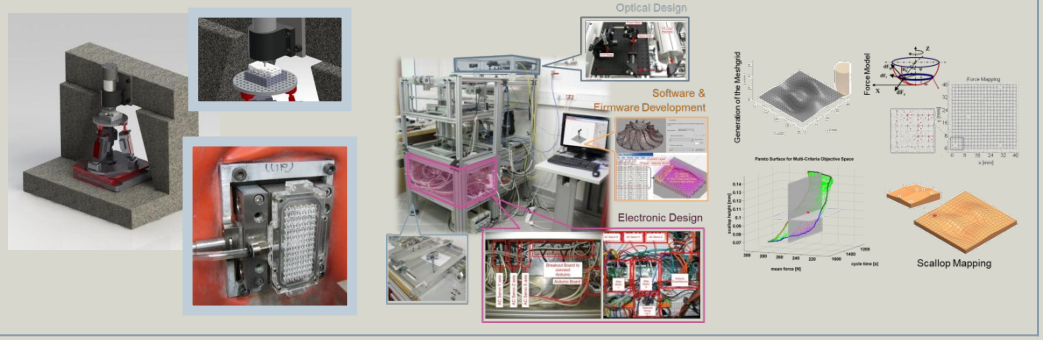
Sensing



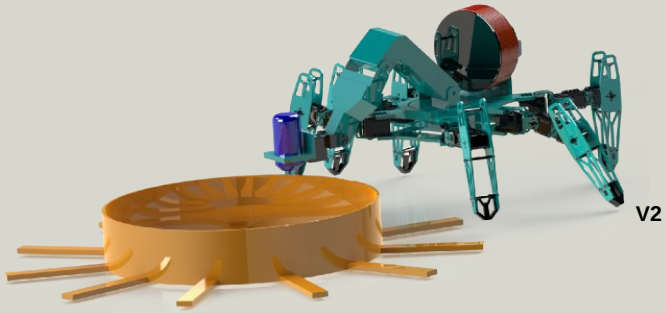
Flexible Electronics



Advanced Manufacturing



Robotics



2011/2014

Hasan Sinan Bank

Portfolio – Selected Projects

An Agile Manufacturing System – Siemens Seedfunding Award 2015 in Automation and Control, US Region

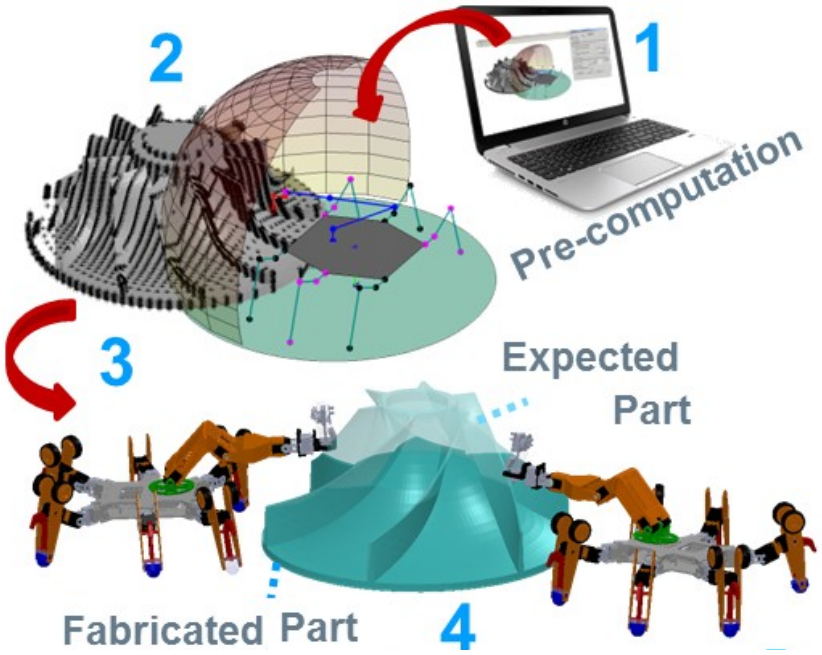
Objective

Develop a modular, collaborative additive manufacturing system (SIAMS) with mobile robots – Siemens Spiders (SISPIs)

Significance

- Developing highly scalable manufacturing system
- Reducing build time through parallel manufacturing
- Having unlimited 2D -3D w/ ladders- workspace
- Allowing on-location printing, service, and repair
- Enabling manufacturing in austere or hostile environments

Approach



Bank, H.S., Dalloro. L., Siemens Agile Manufacturing System, Application No: 62/ 081,260
Bank, H.S., Srivastava, S., Mirabella, Dalloro, L., An Agile Manufacturing System[AMS]: A Framework for Scalable Mobile Robots in Digital Manufacturing, ASME IDETC, 2016

Paper-based Touch Pads with Reduced Number of Electrodes

Objective

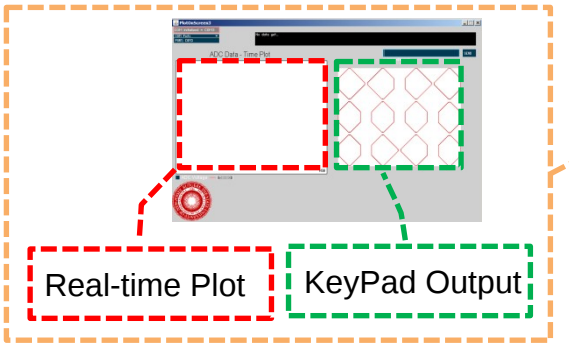
Create a disposable user interface; detect and further our understanding of the electrical properties of human touch; and keep the cost low.

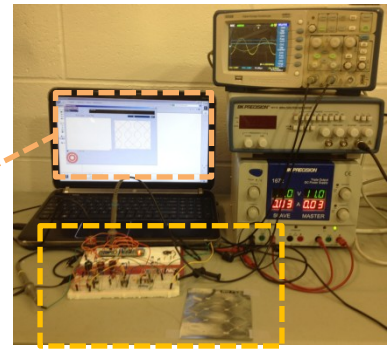
Significance

- Reduce the complexity of connections to paper-based touch pads,
- Enable the use of touch pads in books and other media

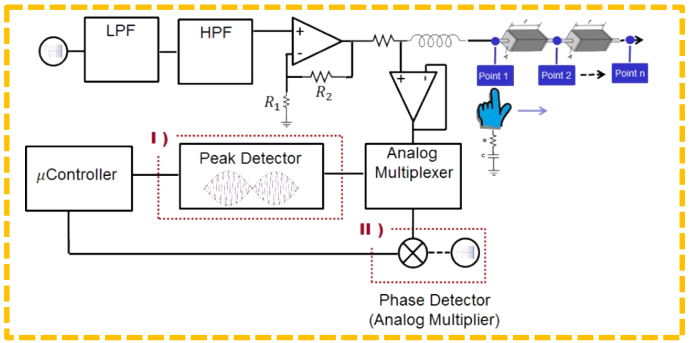
Experimental Setup:

Acquisition Software:

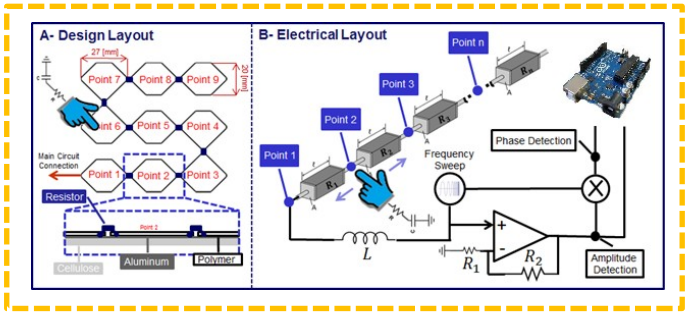




Output Impedance Circuit:



Equivalent Circuit:



Transfer function of the touch pad:

$$\frac{V_{out}}{V_{in}} = \left(1 + \frac{R_g}{R_f}\right) \times \left(\frac{Z_1}{Z_L + Z_{Fin} + Z_2 + Z_3 + \cdots Z_n}\right)$$

Bank, H.S., Dranadula, R., Mazzeo, A.D., A Strategy for Detection of Human with Paper-based Touch Pads, ASME IMECE 2014 – 37550

Contact Imprinting for Disposable Paper-based Flexible Electronics

Objective

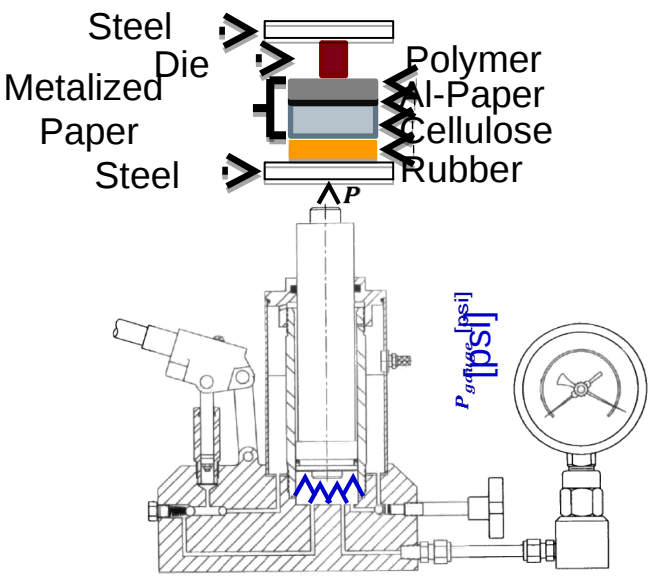
This project is aimed to create a contact based imprinting for flexible electronics to fabricate structures in low-cost, repeatable, and facility-free manner.

Significance

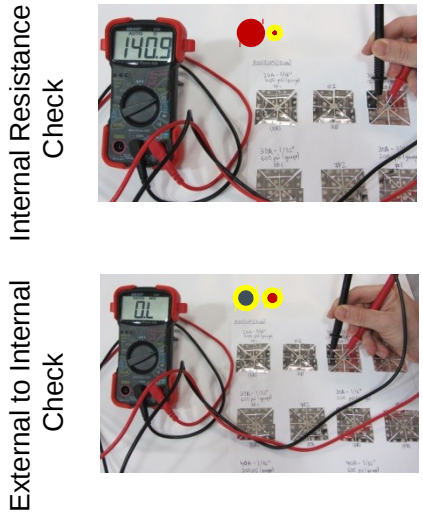
- Electrical and mechanical characterization of metallized paper for embossing process
- Patterning of metallized paper might be amenable to roll-to-roll (R2R) processing

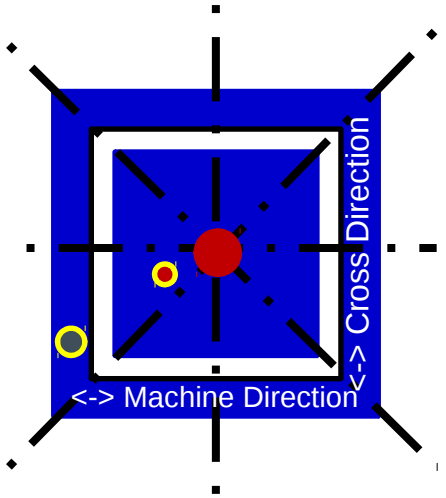
Experimental Setup:

Mechanical Experiments



Electrical Experiments





Bank, H.S., Bajorek, M., Mazzeo, A.D., Contact Imprinting for Disposable Paper-based Flexible Electronics, Building Electronics on Paper - Why, How & Who FlexTech Alliance Workshop Western Michigan University , 2013

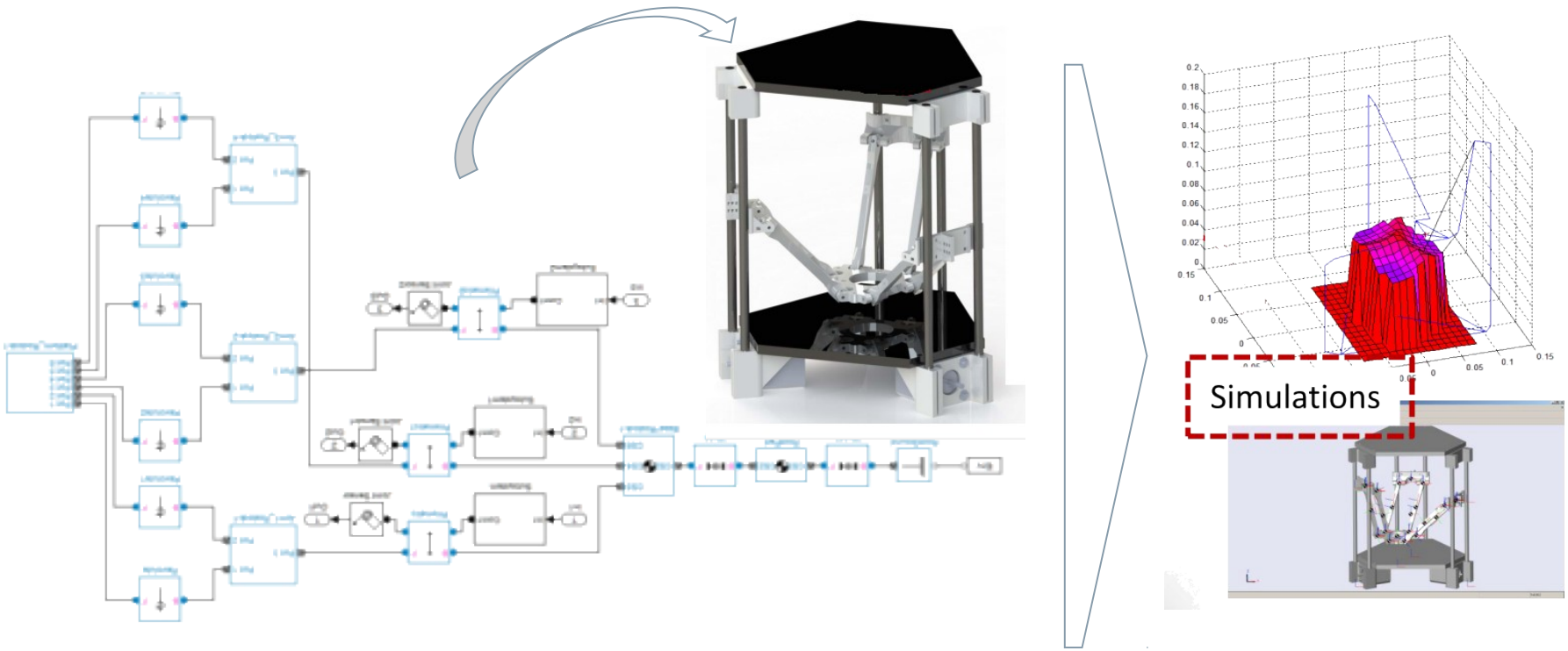
Virtual Design and Analysis of 3-PUU Type Hybrid Parallel Kinematic Manipulator

Objective

Design and simulation of 3-PUU Type parallel kinematic manipulator for dynamical, structural, manipulability, stiffness, and dexterity.

Significance

Virtual simulations would realize complex control algorithms, optimization, and analysis of the robotic structure without the requirement of the physical system.



Embedded Capacitive Sensing for Micro-rolling Process

Objective

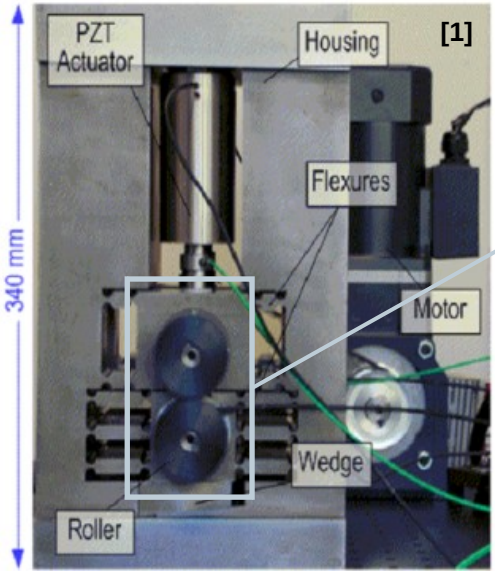
The objective of this project is investigating the mechanical deformation and thereof developing an embedded sensor system for electrified micro-rolling process.

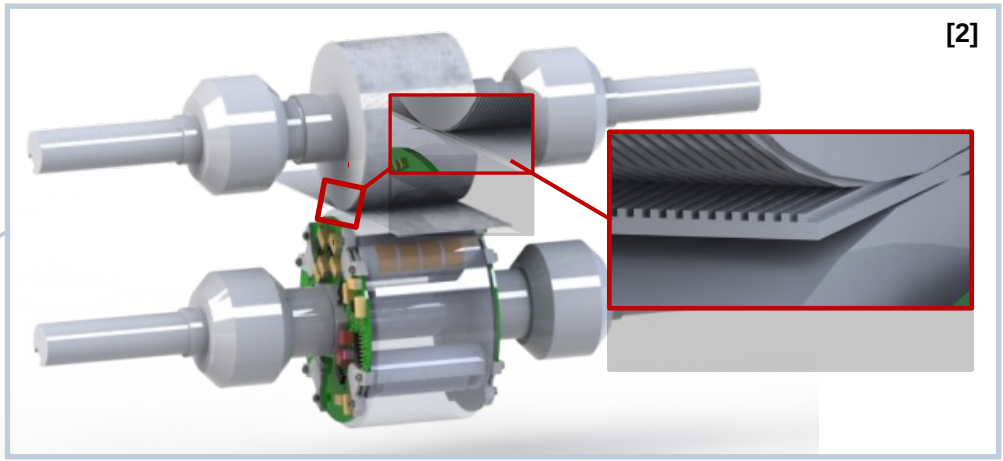
Completed Tasks

Design and implementation of a finite element model to optimize the location of sensors and batteries,

Design and manufacturing of the system (mechanical and electronics),

Development of software for data acquisition





Earlier Research Results

Fan, Zhaoyan, et al. "Real-time monitoring of pressure distribution in microrolling through embedded capacitive sensing." *CIRP Annals-Manufacturing Technology* 61.1 (2012): 367-370.

Project Related Publications:

Gao, Robert X., Zhaoyan Fan, and Jian Cao. "Methods And Apparatus For Monitoring Microrolling Processes Using Embedded Sensing." U.S. Patent Application 14/214,058.

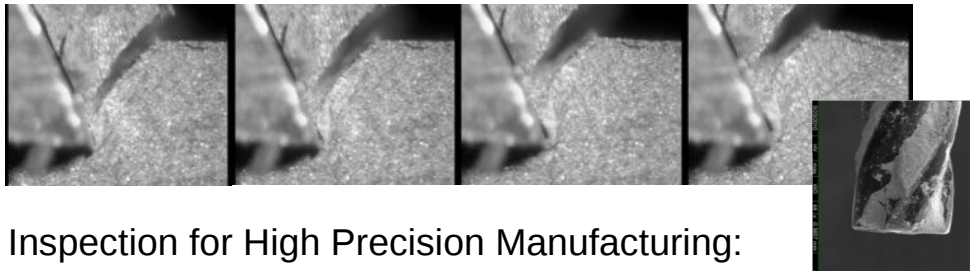
-Not Included any patents or publications-

Micromachining of Green Ceramic Compacts

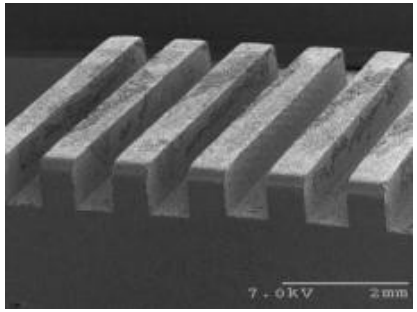
Objective

The objective of this project is using milling and drilling tools to create micro shapes on green compacts after powder injection molding [PIM].

The Engagement of the Tool and Green Ceramic Compact:

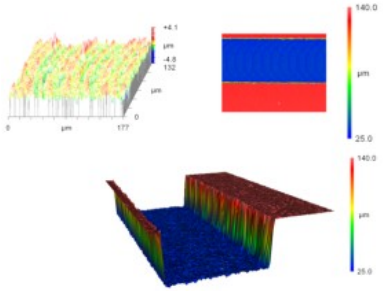


Inspection for High Precision Manufacturing:

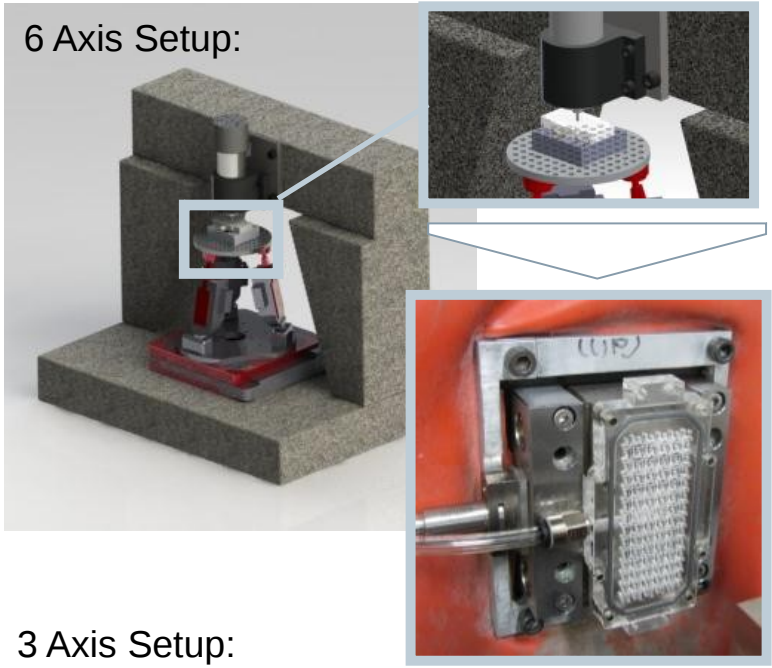


Scanning Electron Microscope

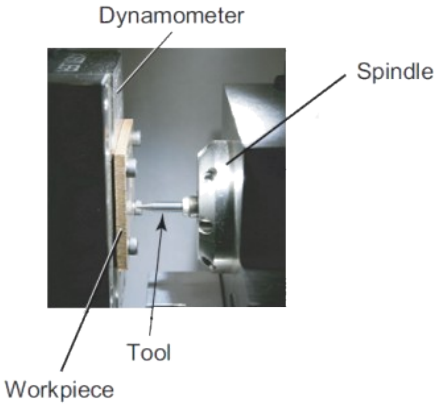
Optical Profilometry

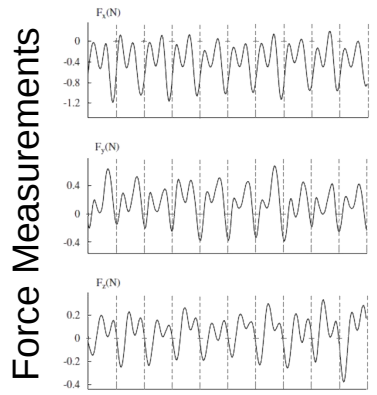


6 Axis Setup:



3 Axis Setup:





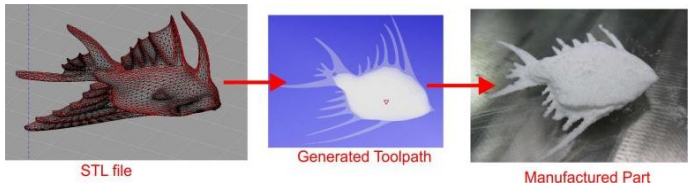
Development of a Hybrid and Open-architecture Laser Workstation

KOÇ UNIVERSITY

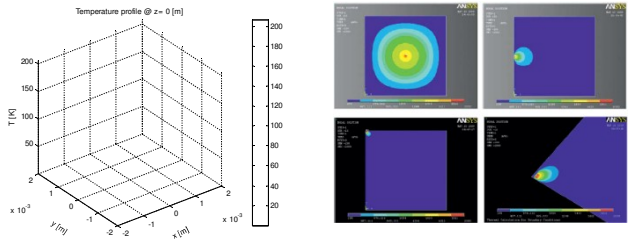
Objective

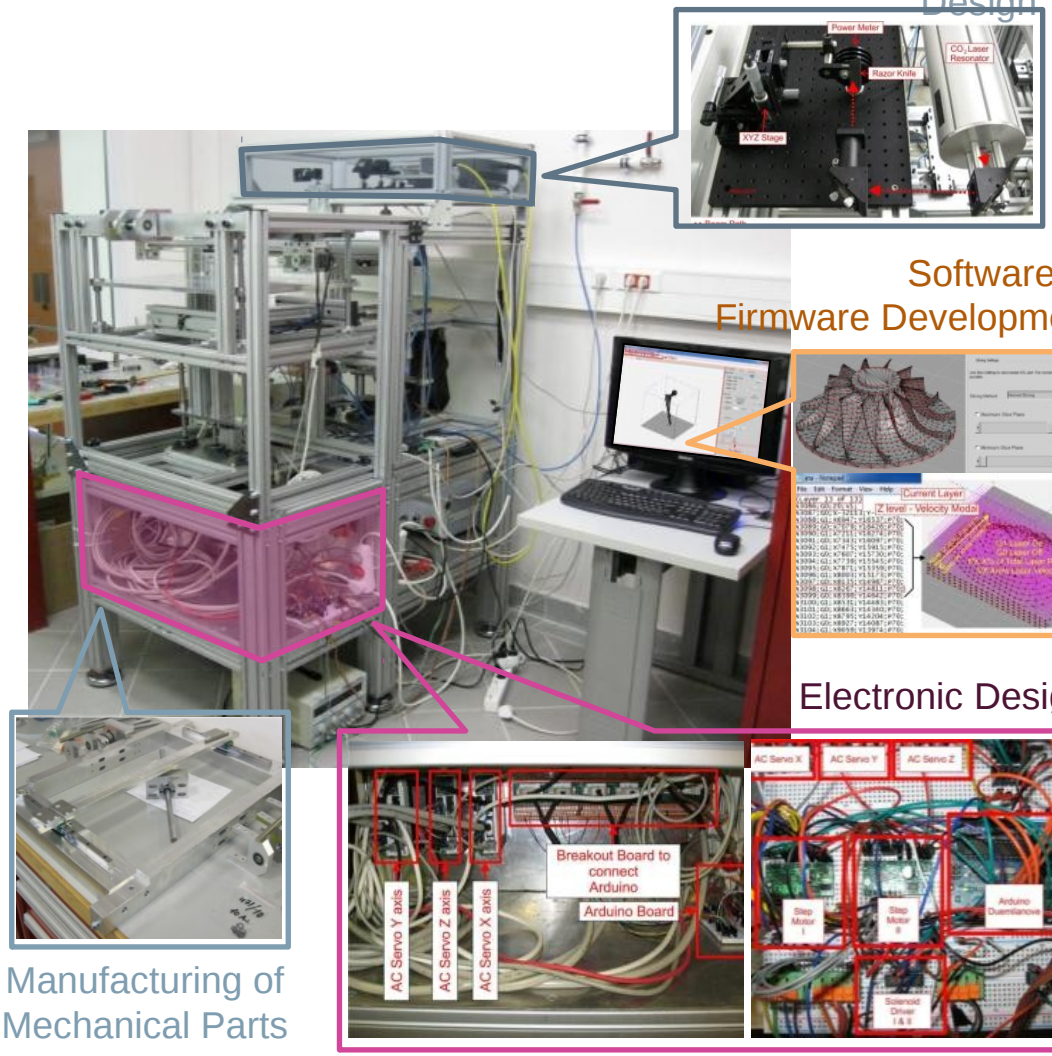
In this project, we developed a hybrid laser workstation which is capable of laser machining and sintering of polymers, metals, or organic materials (e.g. cellulosic composites).

Result:



Analysis of the Process:



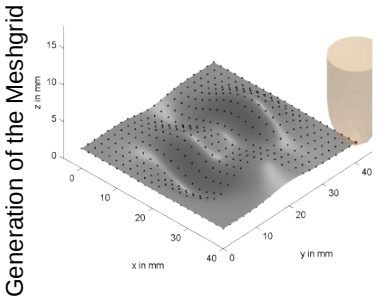


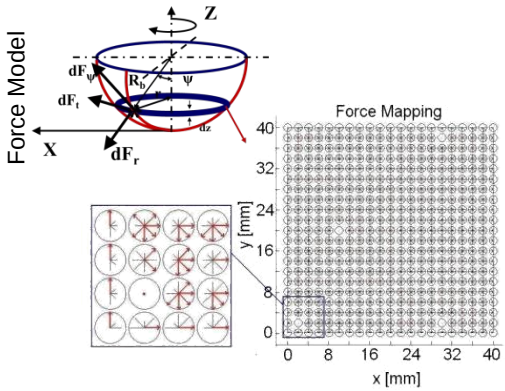
Bank, H.S., Lazoglu I., "Development of an Hybrid Laser Workstation for Additive Manufacturing and Laser Machining", 15th Int. Conference of Machine Design and Production, Denizli, Turkey, 2012

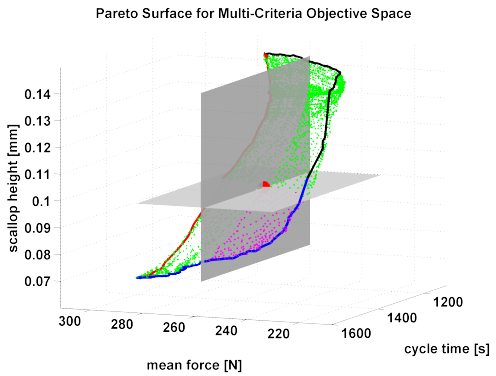
Intelligent Tool Path Selection via Multi-criteria Optimization in Complex Sculptured Surface Machining

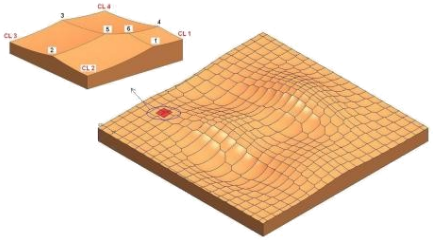
Objective

The objective of this project is creating a new toolpath generation algorithm via multi-criteria optimization for ball end-milling operation of sculpture surfaces.









Scallop Mapping

Approach

CL Determination on the Meshgrid

Modeling of Criteria Predictions (e.g. Force Model, Scallop Model)

Determination of Criteria Maps on the Meshgrid (e.g. Force, Scallop and Time Map)

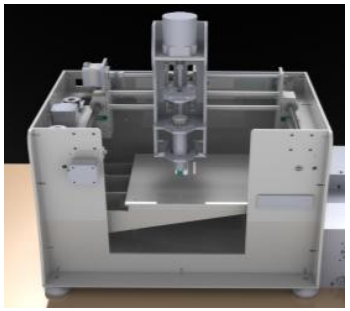
Optimization of All Criteria Maps Together (Network Optimization)

Manav,C., **Bank, H.S.**, Lazoglu, I., “Intelligent Tool Path Selection via Multi-Criteria Optimization in Complex Sculptured Surface Milling”, Journal of Intelligent Manufacturing, 2013

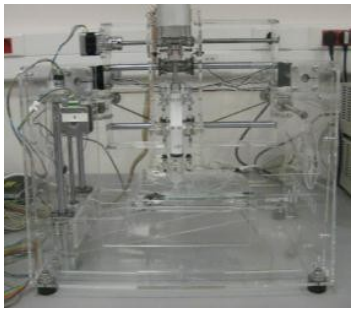
Mechatronic Design for Manufacturing Bioactive Scaffolds in Tissue Engineering

Objective

Design and manufacturing of a low-cost and lab-scale 3D printer for polymeric functional design such as bio-printers.

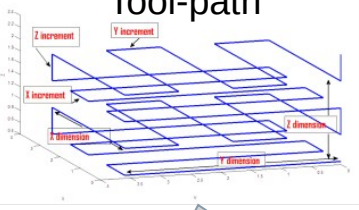


Rendered CAD Design

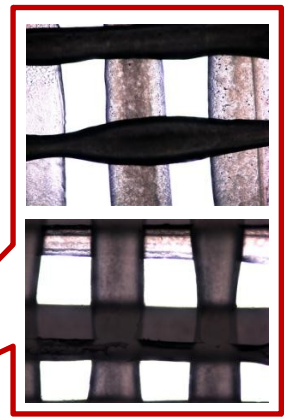


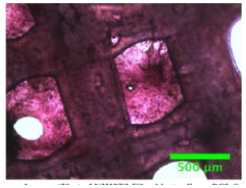
3D Printer

Tool-path

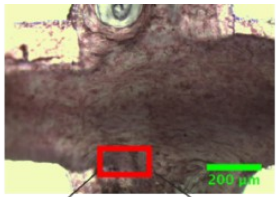


Printing the tool-path

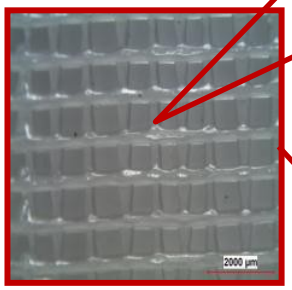




NIH3T3 Cells on Printed Scaffold



Printed Scaffold



Followed steps after printing the scaffolds:

Cell Seed, Attachment, and Proliferation

Hematoxylin and Eosin Staining, Cytotoxicity Tests

PCL Scaffold Powder Preparation

Izbassarov, D., **Bank, H.S.**, Lazoglu, I., “Mechatronics Design for Manufacturing Bioactive Scaffolds in Tissue Engineering”, 2011, Unpublished Manuscript

Thank you!

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https://www.github.com/bankh