## Innovative Design and Manufacturing Laboratory

**Welcome to IDEAL Research Group Website.**

Our research focuses on the sustainable design and manufacturing, bioenergy production processes and systems, cyber-physical control and optimization, and operations research. The research work at **I**nnovative **De**sign and M**a**nufacturing **L**ab **(IDeaL)** emerges areas crucial to providing industry and society with responsible products, systems, and services necessary for improving the quality of life.

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## Laboratory Members

### Faculty and Lab Director

**Amin Mirkouei, Ph.D.**

[**Assistant Professor**](http://www.uidaho.edu/engr/our-people/amin-mirkouei)

[College of Engineering](http://www.uidaho.edu/engr/our-people/idaho-falls)

[Industrial Technology,](http://www.uidaho.edu/degree-finder/industrial-technology/bs-industrial-technology)[Technology Management](https://www.uidaho.edu/engr/programs/technology-management)

Affiliated Faculty of [Mechanical Engineering Dept.](https://www.uidaho.edu/engr/departments/me)

[University of Idaho - Idaho Falls](http://www.uidaho.edu/engr/our-people/idaho-falls)

Dr. Amin Mirkouei is an Assistant Professor in Industrial Technology and Technology Management programs, as well as an affiliated faculty of Mechanical Engineering Department at the University of Idaho in Idaho Falls, where he directs the Innovative Design and Manufacturing Laboratory. Before his faculty assignment at the UI, he was a Visiting Assistant Professor in Department of Mechanical Engineering at the Georgia Southern University. He holds a Ph.D. in Industrial Engineering with a minor in Business Administration and concentration in Manufacturing Systems Engineering from Oregon State University and an M.S. and B.S. degrees also in Industrial Engineering from the University of Tehran and Islamic Azad University, Iran. As listed in his [Curriculum Vitae,](http://webpages.uidaho.edu/mirkouei/CV.pdf) his considerable portfolio of academic papers, conference presentations, reviewer invitations by scholarly journals, and his membership in prestigious professional organizations (e.g., ASME, IISE, and SME) evidently indicate his wide recognition within the scientific sphere.

### Ph.D. Students

### M.S. Students

### B.S. Students

The **I**nnovative **De**sign and M**a**nufacturing **L**ab **(IDeaL)** aims to maintain many research opportunities that can positively impact all segments of manufacturing processes and systems. Therefore, we plan to undertake research in the following Thrusts:

**Thrust 1. Sustainable Design and Manufacturing**

The integration of manufacturing and sustainability creates an effective and efficient infrastructure for the industry to strive towards more sustainable production. Hence, the knowledge of various domains of manufacturing, specifically advanced manufacturing and sustainability decision making needs to be integrated and help promoting the sustainable design and manufacturing at the macro and micro level. The overarching aim of this thrust is to bridge the gap between knowledge discovery and technology (e.g., new tools and machines) implementation in manufacturing and improve the performance of the growing manufacturing sector, by focusing on different aspects of sustainability (e.g., life cycle assessment, energy monitoring and analysis, process energy optimization strategies, and social assessment methods).

**Thrust 2. Bioenergy Processes and Systems Modeling**

According to U.S. Department of Energy, over 80% of U.S. energy is provided from fossil-based energy sources. Government and societal interest in renewable energy sources have put additional scrutiny on the system structure and process-level operations, due to several challenges attendant with conventional energy sources such as environmental, energy security, and human health challenges. This research thrust is expected to develop system engineering models that can be applied in the analysis of renewable and conventional energy systems to support process planning efforts for energy efficiency improvement and the use of alternative energy in traditional processes and equipment.

**Thrust 3. Cyber-Physical, Cross-Layer Control and Optimization**

This project centers on real-time process evaluations and data-driven manufacturing in order to advance energy cyber-physical systems (ECPS) and support sustainability efforts in biomass-based energy production processes. The motivation behind the proposed approach lies in inherent system failures and constraints of the existing methods in such processes. This research thrust is expected to design and empirically verify a Cyber-physical Real-time Monitoring and Control of Catalytic Fast Pyrolysis (CRM2CFP) platform for bioenergy (bio-oil and biofuels) production from algae and terrestrial feedstocks.

**Thrust 4. Logistics and Supply Chain Planning**

Supply chains often develop in an ad hoc, evolutionary manner, inhibiting optimal design. Hence, a generalized decision support framework for the design of optimal and sustainable supply chain are required. The broader goal of this research thrust is to identify and quantify economic and environmental performance metrics through mathematical modeling, life cycle analysis, and geographical information systems.

## Refereed Publications and Proposals

You can find the latest list of my publications on either [Google Scholar](https://scholar.google.com/citations?user=uMhYn9YAAAAJ&hl=en) or [ResearchGate](https://www.researchgate.net/profile/Amin_Mirkouei).

(\* Corresponding Author)

### Archival Journals

* **Mirkouei, A.\***, K. R. Haapala, J. Sessions, and G. S. Murthy, 2017,*"Evolutionary Decision Making for Biomass-based Energy Supply Chains"* Applied Energy, (in Press).
* **Mirkouei, A.\***, K. R. Haapala, J. Sessions, and G. S. Murthy, 2017,*"A Review and Future Directions in Techno-Economic Modeling and Optimization of Upstream Forest Biomass to Bio-oil Supply Chains,"* Renewable & Sustainable Energy Reviews, RSER6200, DOI: 10.1016/j.rser.2016.08.053.
* **Mirkouei, A.\***, P. Mirzaie, K. R. Haapala, J. Sessions, and G. S. Murthy, 2016,*"Reducing the Cost and Environmental Impact of Integrated Fixed and Mobile Bio-oil Refinery Supply Chains,"* Journal of Cleaner Production.
* Davarpanah, MA. **A. Mirkouei**, X. Yu, R. Malhotra\*, S. Pilla, 2015,*"Effects of incremental depth and tool rotation on failure modes and microstructural properties in Single Point Incremental Forming of polymers,"* Journal of Materials Processing Technology 222, 287-300.

### Conference and Symposium Proceedings

* **Mirkouei, A.\***and Kardel, K., 2017,*"Enhance Sustainability Benefits Through Scaling-up Bioenergy Production from Terrestrial and Algae Feedstocks,"* Proceeding of the 2017 ASME-IDETC, Cleveland, Ohio, USA.
* **Mirkouei, A.\***, Silwal B., and Ramiscal L., 2017,*"Enhancing Economic and Environmental Sustainability Benefits across the Design and Manufacturing of Medical Devices: A Case Study of Ankle Foot Orthosis,"* Proceeding of the 2017 ASME-IDETC, Cleveland, Ohio, USA.
* **Mirkouei, A.\***, Bhinge, R., Haapala K. R., Dornfeld, David A., 2016,*"A Pedagogical Module Framework to Improve Scaffolded Active Learning in Manufacturing Engineering Education,"* Proceeding of the 2016 NAMRC/SME, June 27-July 1, Blacksburg, Virgina, USA. [(Award Abstract #1547112)](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1547112)
* **Mirkouei, A.\***, K. R. Haapala, J. Sessions, and G. S. Murthy, 2015,*"Forest Biomass-to-Bioproducts Supply Chain under Real-World Uncertainty,"* Proceedings of the IIE/ISERC, May 21-24, Anaheim, California, USA.
* **Mirkouei, A.\***, A. Afrasiyabi, K. R. Haapala, J. Sessions, and G. S. Murthy, 2015,*"Environmental Analysis of a Mixed-Mode Forest Biomass-to-Bio-oil Supply Chain,"* Proceedings of the IIE/ISERC, May 21-24, Anaheim, California, USA.
* **Mirkouei, A.\***and Haapala, K. R., 2015,*"A Network Model to Optimize Upstream and Midstream Biomass-to-Bioenergy Supply Chain Costs,"* Proceedings of the ASME 2015 International Manufacturing Science and Engineering Conference.
* **Mirkouei, A.\***and Haapala, K. R., 2014,*"Integration of Machine Learning and Mathematical Programming Methods into the Biomass Feedstock Supplier Selection Process,"* 24th International Conference on Flexible Automation and Intelligent Manufacturing (FAIM), May 20-23, 2014, San Antonio, Texas. [(PDF)](http://digital.utsa.edu/cdm/ref/collection/p15125coll7/id/7175)

### Grant Proposals

* *"CRII: CPS: Cyber-physical Real-time Monitoring and Control of Catalytic Fast Pyrolysis (CRM2CFP),"* (**PI: A. Mirkouei**), NSF-CISE, CRII Program, $175,000, submitted Aug. 02, 2017.
* *"Collaborative Research: SusChEM: Multi-Criteria Decision Making for Enhancing Sustainable Benefits Across The Mixed Biomass-To-Bioenergy Supply Chain,"* (**PI: A. Mirkouei** along with 3 co-PIs), NSF-CBET, Environmental Sustainability Program, $300,000, submitted Oct. 19, 2016.
* *"An Educational Module for Sustainable Additive Manufacturing,"* (**co-PI: A. Mirkouei**), CACHE Corp. (NSF-funded Sustainable Manufacturing Advances in Research and Technology Coordination Network), $4,000, submitted Oct. 1, 2015.
* *"A Pedagogical MTConnect Module to Improve Scaffolded Active Learning in Manufacturing Engineering Education"* (**PI: A. Mirkouei**), Dept. of Defense, MTConnect Student Challenge: Idea Creation, $10,000, submitted June 9, 2015.[(Abstract)](https://www.challenge.gov/files/2016/03/A-Pedagogical-MTConnect-Module-to-Improve-Scaffolded-Active-Learning-in-Manufacturing-Engineering-Education.pdf)
* *"Integrated Biomass-to-Bioenergy Supply Chain Planning under Real-World Uncertainty,"* (**PI: A. Mirkouei**), 2014 Student Sustainability Initiative, $4,800, submitted May 23, 2014.

## Teaching

### University of Idaho

* Human Performance Fundamentals (INDT 464) - Fall 2017
* Engineering Design Software (TM 502) - Fall 2017

### Georgia Southern University

* Manufacturing Processes (MENG 1310) - Fall 2016 and Spring 2017
* Solid Modeling & Analysis (ENGR 2112) - Spring 2017
* Manufacturing Processing Studio (MENG 3333) - Spring 2017
* Engineering Graphics (ENGR 1133) - Fall 2016

### Oregon State University

* Computer-aided Design and Manufacturing (ME 413) - Summer and Fall 2015, Summer 2016
* Production Engineering (MFGE 336) - Winter and Spring 2016 (Lab Instructor)

#### Guest Speaker

* + Industrial Sustainability Analysis (MFGE 535) - Fall 2015
  + Production Engineering (MFGE 336) - Spring 2015

#### Lab Development

* + Computer Control of Manufacturing (MFGE 599) - Spring 2015

## Graduate and Undergraduate Research Opportunities

We are seeking qualified Ph.D. and M.S. candidates to be responsible for conducting research in the broad area of design and manufacturing, particularly, designing and controlling bioenergy production processes, such as pyrolysis and hydrothermal liquefaction.

### Qualification:

1. Familiar with Python for programming, SolidWorks for design, AspenPlus for conversion technology simulation, and LabVIEW for data collection and simulation.

2. With a background in Mechanical Eng. or Biological Eng.

### Supports:

Department support will be granted based on the qualifications and experience.

Students interested in conducting research on the aforementioned Research Thrusts are encouraged to contact Dr. Mirkouei.

### 2017

* Paper Review Coordinator Appreciation Award from 2017 ASME-IDETC/CIE Conference, (08/2017)

### Prior to 2017

##### The followings highlight the latest awards and honors that Dr. Mirkouei's research has achieved:

* Design for Manufacturing and the Life Cycle Scholar Award from ASME Conference, (08/2016)
* [National Science Foundation (NSF) Student Travel Award](https://www.research.gov/research-portal/appmanager/base/desktop;jsessionid=WjDVWS0NqSNLX3QNt8LqDFffW1lzpqvPQ1T4RcyYvG5X6fMtwgCZ!-1244237534!-516028241?_nfpb=true&_windowLabel=rsrRecentAwards_2&wsrp-urlType=blockingAction&wsrp-url=&wsrp-requiresRewrite=&wsrp-navigationalState=&wsrp-interactionState=wlprsrRecentAwards_2_action%3DviewRsrDetail%26wlprsrRecentAwards_2_fedAwrdId%3D1619682&wsrp-mode=wsrp%3Aview&wsrp-windowState=#0)  for IIE/ISERC Conference,(04/2016)
* NSF Honorarium, To Develop a Sustainable Additive Manufacturing Educational Module (03/2016)
* 2nd Place, IE Graduate Research Expo Award, School of MIME, College of Engineering, OSU (03/2016)
* IE Outstanding Graduate Teaching Assistant Award, School of MIME, OSU, (05/2015)
* NSF Student Travel Award for ASME/MSEC Conference,(04/2015)
* International Program Student Scholarship, OSU, (04/2014)

## Contact [Dr. Mirkouei](http://www.uidaho.edu/engr/our-people/amin-mirkouei) with your comments, questions, and feedback.

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