

Bashir Khoda, Ph.D.
Associate Professor
Digital Manufacturing Research Group
Department of Mechanical Engineering,
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1. Professional Appointments

Associate Professor & Smart Manufacturing Coordinator Mechanical Engineering Department, The University of Maine Affiliated Faculty, Bio-medical Science and Engineering, UMaine Affiliated Faculty, Advanced Structures and Composites Center (ASCC), UMaine Affiliated Faculty, Interdisciplinary Material Science and Engineering Program, UMaine	2022-Present
Assistant Professor Mechanical Engineering Department, The University of Maine	2019-2022
Assistant Professor Industrial & Manufacturing Engineering Department, North Dakota State University Affiliate Faculty, Biomedical Engineering Program, NDSU Research Faculty, Center for Sustainable Material Science	2013-2018 2016- 2018 2017- 2018
Instructor University at Buffalo, Industrial and Systems Engineering Department	2011- 2013
Research and Teaching Assistant University at Buffalo, Industrial and Systems Engineering Department, Buffalo, NY	2007-2012
Lecturer Bangladesh University of Engineering & Technology, Industrial and Production Engineering Department Dhaka, Bangladesh	2004-2007
Engineering Trainee Process Engineer PRAN-RFL Food Industries, Bangladesh	2002

2. Academic Qualifications

PhD in Industrial and Systems Engineering <i>University at Buffalo, The State University of New York (SUNY), Buffalo, New York, USA</i> <ul style="list-style-type: none">• IIE Doctoral Colloquium (IERC 2011) Nominee, University at Buffalo.• Future Faculty Workshop, 2011 Nominee, University at Buffalo.• “Target Your Teaching” 2011 Participant, University at Buffalo.	2013
Master of Science (MSc) in Industrial and Production Engineering <i>Bangladesh University of Engineering and Technology (BUET), Dhaka.</i> University Gold Medalist 2007	2007
Bachelor of Science (BSc) in Industrial and Production Engineering <i>Bangladesh University of Engineering and Technology (BUET), Dhaka.</i> <i>Deans’ list award</i>	2004

3. Research and Scholarly Contributions

3A. Research Focus

Research goal: *Enhance manufacturing competitiveness through digital innovation and intelligence.*

My research is focused on three pillars: (i) design, (ii) materials, and (iii) processes of advanced manufacturing and digitization. The research area covers bio-ink design; bio-CAD & manufacturing; novel process for periodic and non-periodic metal lattice structures; artificial intelligence-driven framework for advanced manufacturing; design for additive manufacturing. The research marked a shift in the way scientists think about part-process-performance, allowing a synchronized approach between topology, material, and manufacturing/delivery systems stitched with data synchronization which is evaluated in both digital and physical environments. My research aims to provide a manufacturing innovation platform for capturing advanced manufacturing ingenuity in the critical sectors of the US economy (healthcare, aerospace, automotive, and consumer goods). The scholarly program objectives are to pursue the scientific questions in manufacturing science, procure major grant funding, to continue collaboration on projects through multidisciplinary teams (ASCC, AMC, FIRST, Bio-medical Engineering Department, Department of Chemistry, Jackson Laboratory).

3B1. Successful External Funding

- 1) **NSF-CMMI-MOMS:** “Collaborative Proposal: Mechanics of Knots and Tangles of Elastic Rods” Duration: Oct 21-Sep 24; Role: PI; Amount: \$141,905.
- 2) **US-DOT # 693JK31850009CAAP:** “New Bio-Inspired 3D Printing Functionalized Lattice Composites for Actively Preventing and Mitigating Internal Corrosion” Duration: Sep 18-Aug 21; Role: co-PI (50%); Total Amount: \$375,000; PI: Zhibin Lin, (\$127,827 Transferred to UMaine).
- 3) **US Army-Natick Contracting Division:** “Expeditionary Maneuver Support Materials and Structures – Natick Option 2” Duration: Jan 22- Dec 25; Role: co-PI (5%); **Khoda’s Amount:** \$414,244.
- 4) **US Army-Natick Contracting Division:** “Expeditionary Maneuver Support Materials and Structures - Option 2” Duration: Oct 19- Aug 22; Role: co-PI (10%); **Khoda’s Amount:** \$527,686.
- 5) **US Army-Natick Contracting Division:** “Expeditionary Maneuver Support Materials and Structures – Natick Option 1” Duration: Oct 20- Oct 23; Role: co-PI (10%); **Khoda’s Amount:** \$188,499.
- 6) **NASA Seed Grant:** “Bioprinted blueberry plant cells as a multi-use product for long-term space exploration” Duration: Sep 22- Aug 23; Role: PI (25%); Total Amount: \$80,000.
- 7) **NSF #OIA-1355466** INSPIRE-ND Center for Sustainable Material Science (CSMS) “Bio-based polymers and composites for additive manufacturing”; Duration: Sep 17-Sep, 19; **Khoda’s Amount:** \$211,250.
- 8) **NIH-COBRE #P20GM109024** CDTSPC- ‘Bio-manufacturing of cancerous pancreas tissue with controlled gradient hypoxia’ (Pilot Project); Duration: Dec 16-Mar, 17; Role: PI; **Khoda’s Amount:** \$36,250.
- 9) **NSF-DMR- MRI #1625704:** Acquisition of a high-resolution ultrasound imaging instrument for research and education; Duration: Sep 16-Sep, 19; Role: co-PI; Total Amount: \$251,750; Other PI and co-PIs: Sanku Mallik, Amanda Brook.
- 10) **Dept. of Commerce Research-ND Award # 17-08-G-191:** Additive Manufacturing for Mattress Comfort Customization; Duration: June 17-Aug, 18; Role: PI; Total Amount: \$64,000; **Khoda’s Amount:** \$32,000; co-PI: Chad Ulven.
- 11) **Department of Defense:** High Performance Bio-based Polymers for Coatings and Additive Manufacturing; Duration: 01/01/2019 – 12/31/2021; Role: co-PI (25%); Chad A Ulven (PI). Total Amount: \$7,638,673.

3C. Successful Internal Funding (Total Amount: \$3,139,093; Khoda’s Portion: \$309,908)

3C1. from UMaine:

- NU & UMaine joint seed funding, 2021 **Amount: \$50,000 (Khoda's portion: \$25,000)**
- Mentee, EMPOWER mentoring program, 2021 **Amount: \$10,000**
- Bio-manufacturing Collaboration with Jackson Laboratory, 2021 **Amount: \$5,600**
- Bangor Savings Bank and Lyndon Paul LoRusso Faculty Development Award, 2019; **Amount: \$2000**
- UG Research Assistant Grant, Maine-EPSCoR- Duration: 2019; **Amount: \$6,600**

3C2. from NDSU:

- NDSU Research and Discovery Grand Challenge Initiative- 'Center for Engineered Cancer Test-beds' Duration: Nov 16-Nov, 19; Role: co-PI; Total Amount: \$2,974,693; **Khoda's Amount: \$154,908**; PI and coPIs: Kalpana Katti; Rajani Pillai; Nan Yu; Gregory Cook; Sanku Mallik; Dinesh Katti; Bashir Khoda; D.K. Srivastava; Mukund Sibi.
- NDSU Development Foundation Fund (total 4 grants)- Duration: 2014-2016; Role: PI; **Khoda's Amount: \$102,800.**
- ND Governor School Fund- Duration (total 4 grants): 2014-2017; Role: PI; **Khoda's Amount: \$11,600**

3D. Scholarly Publications

3D1. Book Chapters (2):

1. B. Khoda, Chapter 2: Computer-Aided Design of Additive Manufacturing Components (Invited Book Chapter); Laser-Based Additive Manufacturing of Metal Parts: Modeling, Optimization, and Control of Mechanical Properties; Eds. Bian, L., N. Shamsaei, and J. Usher, Taylor & Francis 2017, ISSN# 1351647482.
2. B. Khoda, T.Benny, P. Rao, M. Sealy, and C. Zhou, Chapter 14: Applications of Laser-based Additive Manufacturing, in Laser-based Additive Manufacturing Processes (Invited Book Chapter); Laser-Based Additive Manufacturing of Metal Parts: Modeling, Optimization, and Control of Mechanical Properties; Eds. Bian, L., N. Shamsaei, and J. Usher, Taylor & Francis 2017, ISSN# 1351647482.

3D2. Peer-Reviewed Journal Articles (28):

* Maxwell Blais, A Habib, N Ahasan, A Alam, A Shovon, I. Khalil and Ruinan Xie are Graduate Students

1. I. Khalil, Dezhong Tong, Guanjin Wang, Mohammad Jawed and **B. Khoda**, "Systematic Variation of Friction of Rods", Journal of Applied Mechanics, 2022, p.1-12. <https://doi.org/10.1115/1.4055544>
2. A. Shovon, A. Alam, W. Gramlich and **B. Khoda**, "Micro-particle entrainment from density mismatched liquid carrier system." Scientific Report, 2022, 12, p. 9806. <https://doi.org/10.1038/s41598-022-14162-5>.
3. Habib, M. and **B. Khoda**, "Rheological Analysis of Bio-ink for 3D Bio-printing Processes." Journal of Manufacturing Processes, 2022, 76 p. 708-718 doi.org/10.1016/j.jmapro.2022.02.048.
4. A. Alam, M. Rais-Rohani, K. Berube and **B. Khoda**, "Mechanical Performance of 3d Printed Lattice Structure: Assembled vs Direct Print." 3D Printing and Additive Manufacturing, 2022, 0(0) p. 1-13 doi.org/10.1089/3dp.2021.0207.
5. I. Khalil and **B. Khoda**, "Sorting of Poly-disperse Particle by Entrapment using Liquid Carrier System". Journal of Manufacturing Science and Engineering, 2022, 144(5) p. 054502 doi.org/10.1115/1.4052440.
6. **B.Khoda**, AMMN. Ahsan, and A.N. Shovon, "Dip coating from density mismatching mixture". Journal of Micro- and Nano-Manufacturing, 2021, 9(2) p. 021003. [doi:10.1115/1.4051260](https://doi.org/10.1115/1.4051260)

7. **B. Khoda**, and AMM. Ahsan, "A novel rapid manufacturing process of metal lattice structure from continuous thin rod." 3D Printing and Additive Manufacturing, 2021, 8(2), p. 111-125.
doi:10.1089/3dp.2020.0184
8. **B. Khoda**, A.M.M.N. Ahsan, A.N. Shovon, and A.I. Alam, "3D metal lattice structure manufacturing with continuous rods." Scientific Reports, 2021, 11(1): p. 434. **doi:10.1038/s41598-020-79826-6**. Top 100 materials science Scientific Reports papers in 2021
9. Meaders, C.L., M.K. Smith, T. Boester, A. Bracy, B.A. Couch, A.G. Drake, S. Farooq, **B. Khoda**, *et al.*, "What Questions Are on the Minds of STEM Undergraduate Students and How Can They Be Addressed?" Frontiers' in Education, 2021, 6(28). **doi: 10.3389/educ.2021.639338**
10. Habib, M. and **B. Khoda**, "Fiber Filled Hybrid Hydrogel for Bio-Manufacturing". Journal of Manufacturing Science and Engineering, 2020, p. 1-38. **doi: 10.1115/1.4049479**
11. Nazmul Ahsan, A.M.M. and **B. Khoda**, "Characterizing Novel Honeycomb Infill Pattern for Additive Manufacturing". Journal of Manufacturing Science and Engineering, 2020, 143(2). **doi: 10.1115/1.4048044**.
12. A. Habib, & **B. Khoda**. "Development of clay based novel bio-ink for 3D bio-printing process". Journal of manufacturing process, 2019, 38 pp.76-87; **doi:10.1016/j.jmapro.2018.12.034**.
13. M. A.Habib, Sanku Mallik, Sathish Venkatachalem, & **B. Khoda** "3D Printability of Alginate-Carboxymethyl Cellulose Hydrogel" Materials, 2018, 11(3) pp.454; **doi:10.3390/ma11030454**.
14. AMM Ahsan, Ruinan Xie, **B. Khoda** "Heterogeneous topology design and voxel-based bio-printing", Rapid Prototyping Journal, 2018, 24(7), pp.1142-1154. **doi:10.1108/RPJ-05-2017-0076**
15. A Habib, and **B. Khoda** "Support Grain Architecture Design for Additive Manufacturing", Journal of Manufacturing Processes, 2017, 29 pp. 332-342; **doi:10.1016/j.jmapro.2017.08.008**
16. A Habib, and **B. Khoda** "Attribute driven process architecture for additive manufacturing", Journal of Robotics and Computer Integrated Manufacturing, 2017, 44 pp. 253-265; **doi:10.1016/j.rcim.2016.10.003**
17. N Ahasan and **B. Khoda** "AM optimization framework for part and process attributes through geometric analysis", Journal of Additive Manufacturing, 2016, 11 pp. 85-96, **doi:10.1016/j.addma.2016.05.013**
18. N Ahsan, A Habib and **B Khoda** "Resource based process planning for additive manufacturing," Computer-Aided Design, 2015, 69, 112-125. **doi:10.1016/j.cad.2015.03.006**
19. **B Khoda** "Process Plan for Multi-Material Heterogeneous Object in Additive Manufacturing", Journal of 3D Printing and Additive Manufacturing, 2014, 1(4) pp. 210-218. **doi:10.1089/3dp.2014.0022**
20. I.T Ozbolat and **B Khoda** "Design of a new Parametric Path Plan for Hollow Tissue Scaffolds with Functionally Graded Materials," ASME Journal of Computing and Information Science in Engineering 2014, 14(4), 041005. **doi:10.1115/1.4028418**.
21. **AKM Khoda**. and B. Koc, "Functionally Heterogeneous Porous Scaffold Design for Tissue Engineering", Journal of Computer Aided Design, 2013, 45(11): p. 1276–1293
doi:10.1016/j.cad.2013.05.005
22. **AKM Khoda**, I.T. Ozbolat and B. Koc, "Designing Heterogeneous Porous Tissue Scaffolds for Additive Manufacturing Processes", Journal of Computer Aided Design, 2013, 45(12): p. 1507–1523.
doi:10.1016/j.cad.2013.07.003

23. **AKM Khoda**, and Bahattin Koc, "Designing Controllable Porosity for Multi-Functional Deformable Tissue Scaffolds" Journal of Medical Device, 2012, 6(3): 031003-1-12. **doi: 10.1115/1.4007009**.
24. I.T Ozbolat, **AKM Khoda**, J. Gardella, and B. Koc, "Hybrid Tissue Scaffolds for Controlled Release Applications," Journal of Virtual and Physical Prototyping, 2012, 7(1): p. 37-47. **doi:10.1080/17452759.2012.668700**
25. **AKM Khoda**, I.T. Ozbolat and B. Koc, "Modeling of Variational Gradient Porous Architecture with Multi-directional Filament Deposition in 3D Scaffolds." Journal of Computer Aided Design and Applications 2013. 10(3): p. 445-459. **doi:10.3722/cadaps.2013.445-459**.
26. **AKM Khoda**, I.T. Ozbolat and B. Koc, "A New Functionally Gradient Variational Porosity Architecture for Hollowed Scaffold Design." Journal of Biofabrication 2011. 3(3): p. 1-15. **doi: 10.1088/1758-5082/3/3/034106**
27. **AKM Khoda**, I.T. Ozbolat and B. Koc, "Engineered Tissue Scaffolds with Variational Porous Architecture". ASME Transactions, Journal of Biomechanical Engineering, 2011, 133(1): pp.011001-12. **doi:10.1115/1.4002933**
28. N.R. Dhar, **AKM Khoda**, P. Bala, and M.F. Karim "A Study of Effects of Acid Activated Saw Dust on the Removal of Different Dissolved Tannery Dyes (Acid Dye) from Aqueous Solutions" Journal of Environmental Science & Engineering 2005, 47(2): pp. 103-108.

3D3. Peer-Reviewed Journal Articles Currently Under Review or Ready for Submission (4)

1. A. Alam, A. Shovon, Md Rafiul Hassan, and **B. Khoda**, "In-situ Particle Analysis with Heterogeneous Background: A Machine Learning Approach" (Submitted to Powder Technology)
2. A. Shovon, A. Alam, W. Gramlich and **B. Khoda**, "Effect of MW of PMMA on Particle Transfer by Dip Coating Process from Liquid Particle Carrier System" (Submitted to Progress in Organic Coating).
3. Maxwell B., Scott Tomlinson and **B. Khoda**, "Thermoplastics 3D Printing Using Fused Deposition Modeling on Fabrics." Additive Manufacturing (Draft Ready).
4. A. Alam, A. Shovon, I. Khalil, N. Ahsan, and **B. Khoda**, "Wide gap TLP joining by dipping." Advanced Joining Process (Draft Ready).

3D4. Peer-Reviewed Conference Papers in Proceedings (5 of 46):

1. A.N. Shovon, MI. Khalil, A. Alam and **B. Khoda**, "Effect of Withdrawal Velocity on Particle Entrainment from Density Mismatched Mixture" Procedia Manufacturing MSEC, ASME, 2022.
2. MI. Khalil, and **B. Khoda**, "Size-Based Filtration of Poly-Disperse Micro-Particle by Dipping" Procedia Manufacturing MSEC, ASME, 2022.
3. Maxwell B., Scott Tomlinson and **B. Khoda**, "Thermoplastics 3D Printing Using Fused Deposition Modeling on Fabrics" IMECE, ASME, 2021.
4. MA. Habib, and **B. Khoda**, "A Rheological Study of Bio-Ink: Shear Stress and Cell Viability" Procedia Manufacturing MSEC, ASME, 2021.
5. **B. Khoda**, A.M.M.N. Ahsan, and A.N. Shovon, "Solid Transfer of Large Particles by Dipping in a Heterogeneous Mixture" Procedia Manufacturing MSEC, ASME, 2021.

3D5. Peer-Reviewed Conference Abstracts (3 of 17):

1. Systematic Variation of Friction of Rods, SES, 2022 (Accepted).
2. Micro-particle entrainment from density mismatched liquid carrier system, SES, 2022 (Accepted).
3. Inorganic micro-particles transfer from liquid carrier system by dipping, Society of Rheology, 2021.

3D6. Invited Seminars/Presentations (last 5 years)

1. Invited Seminar 'Research scope and challenges in 3D printing', Mechanical Engineering Department, Dhaka University of Engineering and Technology, July, 2022.
2. Invited Seminar 'Particles Delivery by Dip Coating: A New Additive Manufacturing Process', Mechanical Engineering Department, University of Maine, Sep, 2021.
3. Invited Webinar, Manufacturing and Design Division, Industrial and Systems Engineers (M&D-IISE) 'Printability of hybrid hydrogels: An Assessment for Bio-ink' Feb, 2019
4. Invited Talk "Digital Manufacturing: Pixelization to Voxelization" Mechanical Engineering Department, University of Maine, June 2018.
5. Early Career Invited Talk "Performance Driven Cellular Architecture with Manufacturable Topology" Southwest Emerging Technology Symposium (SETS), UT El Paso, April 2018.
6. Invited Presentation "Digital Manufacturing" Military Institute of Science and Technology, Dhaka, Bangladesh, Dec 2017.

3D7. Patent Applications

1. U.S. Provisional Application Robust water/oil separation via co-design of functionalized 3D printing lattice composites. Inventor: Zhibin Lin, **Bashir Khoda**, Long Jiang, Andrew Mahoney, Adeeb Ibne Alam, Xingyu Wang, Hong Pan (Submission Date: Oct 19, 2021, by NDSU).
2. U.S. Provisional Application, A quick and effective method of polydisperse particle sorting by dipping. Inventor: **Bashir Khoda**, Abu Shovon, Ibrahim Khalil and Adeeb Alam (Application Date: Sep 8, 2021, by UMaine).
3. US Utility patent 16/711,364 Automatic Metal Wire Bending (AMWB) Apparatus to Manufacture Shape Conforming Lattice Structure with Continuum Design for Manufacturable Topology (Inventor and Contribution: **Bashir Khoda** (70%), Md. Ahasan Habib, Amm Nazmul Ahsan and Ruinan Xie (30%)) (Application Date: Dec 11, 2019, by NDSU).
4. NDSU RFT-485 – MRG Ref. No. 255.00450160, U.S. Provisional Application No. 62/156,681 Nanoparticles for Delivery of Encapsulated Contents and Methods of Use (Inventor and Contribution: Prajakta Kulkarni (40%), Manas Halder (15%), Sanku Mallik (25%), **Bashir Khoda** (10%), Md. Ahasan Habib (5%), Amm Nazmul Ahsan (5%)) (Provisional patent issued 2016).

3D8. Research Community Related Services

- 1) Invited member, Engineering Research Visioning Alliance (ERVA), Engineering R&D Solutions for Unhackable Infrastructure, MIT 2022.
- 2) External collaborator, Industrial Engineering program at University of Southern Maine (USM), 2022-
- 3) Symposium Organizer on Porous Structure Manufacturing, ASME-MSEC 2020, 2021,2022.
- 4) Reviewer Panelist for NSF-CMMI: 2014, 2016, 2017, 2021, 2022
- 5) Proposal Reviewer (i) DoD/SERDP 2017 (ii) Polish National Science Center (2015).
- 6) Advisory Group Member, Workforce and Educational Outreach (WEO) Committee, America Makes (2017).
- 7) Served IIE Manufacturing & Design Service Award Committee (IIE 2016).

- 8) Conference Committee member, IEOM Orlando, USA, September 10 - 11, 2015.
- 9) Judge, NSF Poster Symposium at the ASME IMECE 2013.
- 10) Host committee Biomimetics, Artificial Muscles and Nano-Bio 2019 (BAMN 2019) International Congress
- 11) Host committee for CAD'12 conference.
- 12) Session Chair: Process, Property, Performance Relationship in Additive Mfg. 1, NAMRC 44.
- 13) Session Chair: CAD/CAM Topics in Additive Manufacturing 1, NAMRC 44.
- 14) Session Chair "Digital Modeling and Manufacturing - I Additive Manufacturing" ISERC 2014, Montreal, Canada.
- 15) Journals/Publications Reviewed: JMP, JMS, CAD, RCIM, RP, Computational Design and Engineering, Journal of Bio-fabrication, 3D printing and Additive Manufacturing, Journal of Manufacturing Science and Engineering, IIE-ISERC, ASME-IMECE, ASME-IDETC, SME-NAMRC, SFF Symposium, Scientific Report.

3D9. Honors, Awards, and Certifications

1. Panel Fellow, 2023 CMMI's Game Changer Academies (CGCA).
2. Nominated for faculty mentor impact award 2019, UMaine
3. Best Paper Award Recipients Manufacturing and Design Division, IIE 2018.
4. Winner, America Makes Innovation Sprint: Additive Manufacturing Curricula Challenge, 2017
5. Best Paper Award Recipients (Third Place) Manufacturing and Design Division, IIE 2014.
6. NSF Funded Gateways–ND Cohort 2 Program, Office of Teaching and Learning (2 year teaching methodology project).
7. National Effective Teaching Institute (NETI-1) certificate achieved, Jan 2016.
8. Carl A and Jean Y. White Agricultural Research Award, NDSU 2016-2017
9. Received Development Foundation Grant to establish Additive Manufacturing Lab at NDSU (Sep, 2014).
10. Received "Gordon A. Larson Agricultural Research Award" NDSU 2014 and 2015.
11. University Gold Medalist 2007 (Graduate Student) BUET.
12. Dean's List Award, Undergraduate Studies, BUET (2004).

4. Teaching and Pedagogy Activities

Objective: My near-term teaching objectives are to contribute to the department by teaching several required classes and ensure continuous improvement of the classes that I currently am teaching.

4A. Courses Taught (100% Responsibility)

4A1. At UMaine:

Course Title: MEE 430 Digital Manufacturing

Innovation or enhancement introduced: Project based hands-on learning

First/Last Taught: Spring 2022

No. of Times Taught: 1

No. of Students: 8

Avg. Instructor Rating: 4.75/5.0

Course Title: MEE 330 Manufacturing Engineering

Innovation or enhancement introduced: Developed new course and laboratory, implemented project-based learning.

First/Last Taught: Spring 2020 / Fall 2022

No. of Times Taught: 2

No. of Students: 134

Avg. Instructor Rating: 3.56/5.0

Course Title: MEE 101 Research Learning Experience (RLE) (co-teaching)

Innovation or enhancement introduced: Organized and led a 3-week research module tied to additive manufacturing

First/Last Taught: Fall 2021

No. of Times Taught: 1

No. of Students (Total): 12

Avg. Instructor Rating: Very Good

Course Title: MEE 150 Engineering Mechanics: Statics

Innovation or enhancement introduced: Exercised active learning, buddy activity, problem-solving with groups.

First/Last Taught: Spring 2019 / Fall 2022

No. of Times Taught: 6

No. of Students (Total): 227

Avg. Instructor Rating: 4.24/5.0

Course Title: MEE 697 Mechanical Engineering Projects

Innovation or enhancement introduced: Developed advanced manufacturing research topics.

First/Last Taught: Spring 2021

No. of Times Taught: 1

No. of Students: 3

Avg. Instructor Rating: n/a

Course Title: MEE 487/488 Capstone Design I & II

Innovation or enhancement introduced: Implemented hybrid manufacturing project.

First/Last Taught: Fall 2020/ Spring 2021

No. of Times Taught: 2

No. of Students: 7

Avg. Instructor Rating: n/a

Course Title: MEE 498/499 Honors Directed Study

Innovation or enhancement introduced: Introduced bio-manufacturing research experience to the undergraduate student.

First/Last Taught: Fall 2020/ Spring 2021

No. of Times Taught: 2

No. of Students: 1

Avg. Instructor Rating: n/a

4A2. At NDSU:

Course Title: IME 380 CAD/CAM for Manufacturing

Innovation or enhancement introduced: Developed new laboratory, implemented project-based learning and 3D Printing.

First/Last Taught: Fall 2013 / Fall 2018
No. of Times Taught: 5
No. of Students: 123
Avg. Instructor Rating: 3.21/5.0

Course Title: IME 482/682 Automated Manufacturing Systems

Innovation or enhancement introduced: Developed new laboratory, problem-solving with groups.
First/Last Taught: Fall 2015 / Fall 2018
No. of Times Taught: 4
No. of Students: 185
Avg. Instructor Rating: 3.07/5.0

Course Title: IME 485/685 Industrial and Manufacturing Facility Design

Innovation or enhancement introduced: Developed new course, problem-solving with groups, implemented project-based learning.
First/Last Taught: Spring 2014 / Spring 2018
No. of Times Taught: 5
No. of Students: 170
Avg. Instructor Rating: 3.27/5.0

4A3. At University at Buffalo:

Course Title: IE 406/506 Computer-Integrated Manufacturing

First/Last Taught: Fall 2011 / Fall 2012
No. of Times Taught: 2
No. of Students: 48

Course Title: IE 327 Facility Design and Material Handling

First/Last Taught: Spring 2013
No. of Times Taught: 1
No. of Students: 47

4A4. At Bangladesh University of Engineering & Technology:

Course Title: IPE 104 Engineering Drawing I

First/Last Taught: Spring 2006
No. of Times Taught: 1
No. of Students: 28

Course Title: IPE 204 Engineering Drawing II

First/Last Taught: Spring 2007
No. of Times Taught: 1
No. of Students: 28

Course Title: IPE 205 Manufacturing Process I

First/Last Taught: Spring 2005/ Spring 2006
No. of Times Taught: 2
No. of Students: 57

Course Title: IPE 305 Manufacturing Process II

First/Last Taught: Fall 2005/ Fall 2006
No. of Times Taught: 2
No. of Students: 50

Course Title: IPE 331 Production Process

First/Last Taught: Fall 2005/ Fall 2006
No. of Times Taught: 2
No. of Students: 240

Course Title: IPE 493 Industrial Management

First/Last Taught: Spring 2007
No. of Times Taught: 1
No. of Students: 60

4B. Courses and Lab Assisted as Teaching Assistant

2007-2011

University at Buffalo, Industrial and Systems Engineering Department, Buffalo, NY

- i. IE 409/509 (Six Sigma Quality Control);
- ii. IE 584 (Computer-Aided Bio-modeling & Fabrication in Biomedical Eng);
- iii. IE 320 (Engineering Economy);
- iv. IE 406/506 (Computer Integrated Manufacturing);
- v. IE 327 (Facility Design & Material Handling);
- vi. IE 504 (Facility Design)

4C. New Courses Developed

4C1. at UMaine:

MEE430: Digital Manufacturing (Spring 2022)

This hybrid course is developed as an undergraduate tech elective and a core course for smart manufacturing graduate concentration at UMaine. The course focuses on various components of DM and their interplay; design and manufacturing information type, their collection, analysis, and utilization. Additionally, additive manufacturing (AM) or 3D printing, a popular tool for DM implementation, will be covered. The topics include process science, design evaluation, material consideration, part characterization, manufacturing data collection, and the economic impact of AM.

MEE330: Manufacturing Engineering (Spring 2020)

This is a core course developed for the undergraduate (Junior) students in the MEE department and is focused on the tools required for innovation in production systems (Concept-Design-Analysis-Prototyping/Manufacturing-Evaluation). The objective of this course is to develop an understanding of the principles of design and manufacturing for the application of product development processes. The syllabus is designed to make this course a 'project-based learning' and the content helps students prepare for the FE exam. In Spring 2021, a new laboratory component was assembled and offered to ensure hands-on activities. The projects are designed to provide the basic concept of manufacturing with the combination of computations and experimentations. Based on the evaluation comments, students found the class valuable for their future career growth. One student comment: "Helped me prepare for the FE. The hands-on projects were very beneficial." I found it very encouraging.

MEE101: Research Learning Experiences (RLE) (3D Printing Module) (Fall 2021)

Research learning experiences (RLE) course is a new initiative for the incoming first-year students. The goal of this course is to develop a broad understanding of the field of mechanical engineering through active participation in analysis, experimentation, exploration, and discovery. I developed the three-week module on 3D printing.

MEE 530: Digital Manufacturing (Spring 2023)

I am currently working on a graduate-level manufacturing systems engineering course and my plan is to submit the syllabus to GEAC by the end 2022. This is a core course for the Smart Manufacturing graduate concentration (serving as coordinator) recently approved by UMS.

4C2. at NDSU:

IME 485/685 Facility Design and Layout

This is a core course for undergraduate students in the IME department and is focused on different facility design methodology and layout algorithms, including industrial engineering tools. This course focuses on facilities planning, emphasizing the design, analysis, and selection of manufacturing/service facilities and material handling systems. The topics covered include facilities planning, the role of the production process and schedule design, the relationship among flow, space, and activity. Students also learn how to determine and utilize the space requirements for personnel and equipment.

4D. New Laboratory Developed and Upgraded

4D1. at UMaine:

1. **Bio-Manufacturing laboratory.** Currently, I am working with the bio-medical engineering department and sharing facilities for bio-manufacturing research. I am co-advising one Ph.D. student and one master's student in biomedical science and engineering. Simultaneously, with graduate students, I am building a bio-manufacturing lab here at UMaine with a suitable space (BSL2) that can support my research activities. My goal is to study the bio-activity of a newly developed bio-ink consist of alginate, Carboxymethyl cellulose, and freeze-dried TOCN with various cell types (living cell, i.e., BXPC3, porc 1, MSC, HEK 293).
2. **Digital Manufacturing Laboratory.** A new advanced manufacturing laboratory is under construction to support student learning and research at UMaine. The laboratory space is on the 2nd floor of the AMC building and will be used by undergraduate and graduate students for conducting research. The lab is currently housing the wire bending apparatus and systems.

4D2. at NDSU:

1. **Additive Manufacturing laboratory.** A new additive manufacturing laboratory is developed to support student learning and research at NDSU. Four different AM process equipment, three different 3D scanners, post-processing work-bench, were acquired using various funds granted to Khoda. The laboratory (Dolve 137) is used by both undergraduate and graduate students for their classes, projects including capstone, various student competitions, and research. Dr. Khoda secured funding from multiple sources for establishing this laboratory.
2. **Automation laboratory.** A complete renovation of the automation laboratory in the IME department was accomplished in Fall 2016. Automation equipment design and selection, syllabus planning, laboratory layout was performed during this process. A laboratory development grant from the provost's office was utilized for this development.
3. **Bio-Manufacturing Laboratory.** A new bio-manufacturing research laboratory is developed by Dr. Khoda to support the research work. The laboratory contains a 400sqft 10000 level cleanroom where the bio-manufacturing research is conducted. The remaining part of this lab contains digital manufacturing-related equipment and supplies. The equipment was purchased using various research grants secured by Khoda.

4E. Student Advising

4E1a. Graduate Research Advisee (UMaine):

1. Ibrahim Khalil (Ph.D.); Tentative Title: Modeling and simulation of poly-disperse particle entrapment on cylindrical substrate. Completion date (Tentative): 06/24; Role: Advisor.
2. Patrick Murphy (M.S.); Tentative Title: Topology optimization ensuring printability. Completion date (Tentative): 8/23; Role: Advisor.

3. Matt Lawrence (M.S.); Tentative Title: Interfacial strength of additively manufactured heterogeneous object. Completion date (Tentative): 8/23; Role: Advisor.
4. Maxwell Blais (M.S.); Title: Thermoplastics 3D printing using fused deposition modeling on fabrics. Completion date: 09/22; Role: Advisor.
5. Abu Naser Shovon (M.S.); Title: Micro-particle entrainment from density mismatching mixture by dip coating process. Completion date: 8/22; Role: Advisor.
6. Adeeb Alam (M.S.); Title: Additively manufactured polymer and metal lattice structure with eulerian path. Completion date: 8/22; Role: Advisor.
7. Aimee Co (M.S.); Tentative Title: Development of a new method for cell spheroid formation through a hydrogel dipping process. Completion date: 05/22; Role: Co-Advisor (with Profs. Mason and Tilburry in Biomedical Eng. program).
8. Sunil Bhandari (Ph.D.); Title: Topology optimization of 3D printed object. Completion date: 12/21; Role: Committee Member.
9. James Anderson (IPh.D.); Title: IPHD Research Topics: Large format thermoplastic additive manufacturing - influence of layer orientation and overhang angle on part properties and processing costs. Completion date (Tentative): 6/24; Role: Committee Member (School of Forest Resources).
10. Don Bones (Ph.D.); Tentative Title: Low temperature depolymerization phenomenon for RAFT polymers and recycling. Completion date (Tentative): 12/23; Role: Committee Member (Dept. of Chemistry).
11. Chase Flaherty (M.S.); Tentative Title: "Feasibility of polymer extrusion welding as a joining application for segmented large-scale additively manufactured thermoplastic tooling structures" Completion date (Tentative): 6/23; Role: Committee Member.
12. Philip Bean (Ph.D.); Tentative Title: "FEA Optimizations of 3D printed parts with spatially varying infills" Completion date (Tentative): 6/23; Role: Committee Member.

4E1b. Undergraduate Research Advisee (UMaine):

1. Jordyn Judkins; Title: Optimization of bio-ink for 3D bio-printing. Completion date: 12/21; Role: Major Advisor.

4E2. Graduated Students as Major Advisor (at NDSU):

1. Md. A Habib (Ph.D.); Title: Designing bio-ink for extrusion-based bioprinting process. Completion date: 6/19; Current Position: Tenure Track Assistant Professor at Keene State, NH.
2. AMM Nazmul Ahasan (Ph.D.); Title: Form and Functionality of Additively Manufactured Parts with Internal Structure. Completion date: 6/19; Current Position: Tenure Track Assistant Professor at Western Carolina University, NC.
3. Ruinan Xie (M.S.); Title: Design and Manufacturing of Variable Stiffness Cellular Architecture. Completion date: 6/17.

4E3. Undergraduate Research Assistant (UMaine):

Brandon Johnstone (2019- 2020); Brad Wilkins (Summer, 2019), Ben Snowiss (2019-)

4E4. Undergraduate Research Assistant (NDSU):

- Research Assistant: Triston Ihrke (2018- Present); Cody Wiese (2014-2018); Zelin Zhang (2017-present); Josh Laxen (Spring 17); Jared Sand (2014-15); Steven Giesler (CE, 2016-2017)
- Research Support: David Syverson and his team (Food Science, Spring 17)
- Participating in NAE Grand Challenge Program: Erik Milender.

4F. Personal/professional development to improve teaching effectiveness

1. Introductory Course Environment - Faculty Learning Community (ICE-FLC) hosted by the Center for Innovation in Teaching and Learning (CITL), UMaine. Cohort 2, 2019-2020.
2. Peer-Reviewed Formative Review Process, hosted by the office of teaching and learning (OTL), NDSU. 2014-2018.
3. National Effective Teaching Institute (NETI-1B) workshop. San Diego, 2016.
4. NSF-funded two-year professional development Gateways-ND project (Cohort 2). 2016-2018.

4G. Committee Services (Teaching)

1. Advisor, Industrial Engineering Curriculum Development program at University of Southern Maine (USM), 2021-2022
2. Member, CoE Bio-based Mfg/LCA Cluster hire white paper committee, UMaine 2020
3. Member, Research Advancement and Advisory Committee (RAAC) 2019, MEE UMaine.
4. Lead, Material and Manufacturing Core Research Group 2019, MEE UMaine.
5. Academic affairs committee, CoE NDSU 2016-2018.
6. Chair, Manufacturing Course/Curriculum Alignment committee 2016-2018, IME NDSU.

5. Professional Services

5A. Book Proposals or Chapters Reviewed

1. Book Proposal: "Additive Manufacturing, 2nd Ed", CRC Press 2017.
2. Reviewer, Book chapter "Chapter 9 - Process Optimization" Laser-based Additive Manufacturing Processes; Eds. John Usher and Linkan Bian. Springer 2017
3. Reviewer, Book chapter "Chapter 10 - Process Monitoring and Control" Laser-based Additive Manufacturing Processes; Eds. John Usher and Linkan Bian. Springer 2017
4. Book Proposal: "Additive Manufacturing Technology", McGraw-Hill 2016.
5. Book Proposal: "Additive Manufacturing of Metals" Edited by Dr. Andrzej L. Wojcieszynski; Springer 2014.

5B. Community Outreach Activities

1. Faculty advisor, 3D printing club, The largest student club of the UMaine System. 2019-
2. Member, Organizing committee Biomimetics, Artificial Muscles and Nano-Bio (BAMN) 2019, Bangor, ME.
3. Coach, FLL Lego League 'Regal Eagle Team 2017-2019' from Eagle Elementary School, Fargo.
4. Mentor, Sunday Academy on Advanced Manufacturing through the NSF supported NATURE program for American Indian high school, 2016-2018.
5. Interviewed with Impact magazine about Fargo Life, 2016.
6. Hosting three high school students from the 'ND Governor School Program' for 6 weeks every summer research project. (Featured news in July 2014 at NDSU homepage)
7. Guest Lecturer for "Geometry and Packaging" to high school Geometry students at Sheyenne High School, Fargo, 2014.
8. Offered advanced manufacturing awareness seminars to various interested parties, i.e., the Rotary Club and local industries.

5C. Other Professional Activities

1. Member of the Institute of Industrial Engineering (IIE); American Society of Mechanical Engineers (ASME); Society for Manufacturing Engineers (SME).
2. Search committee member, Tenure track assistant professor MEE, UMaine 2022.
3. Judge, Student Research Symposium at UMaine, Sep 2020
4. Judge, Graduate Student Council (GSC) Research Symposium at NDSU, April 2018
5. Search committee member, Tenure track assistant professor (total four positions) IME, NDSU: 2014-15, 2015-15, 2016-17 and 2017-18
6. Search committee member, IME Chair Search, 2016-17; CoE Dean search NDSU, 2016-17