

RAJIV MALHOTRA, PhD

Assistant Professor
Department of Mechanical Engineering,
Oregon State University,
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RESEARCH INTERESTS

- Physics-based modeling of manufacturing processes.
- Plasticity and damage in metals, polymers and cellular structures.
- Deformation based forming processes.
 - Low temperature mechanical joining processes.
- Interaction of nanoparticle aggregates with optical, magnetic, electrical and microwave fields.
- Energy-field-assisted processes for rapid sintering of nanoparticles.
 - Sintering mechanisms in multishape, multimaterial, multisized nanoparticle ensembles.
 - Nanoparticle-based manufacturing of 2D functional devices.
 - Nanoparticle-based additive manufacturing of functional devices inside 3D objects.

EDUCATION

- | | |
|---|-----------|
| PhD, Mechanical Engineering
<i>Northwestern University</i> , Evanston, IL
Adviser: Prof. Jian Cao | June 2012 |
| M.Tech, Mechanical Engineering
<i>Indian Institute of Technology Kanpur</i> , Kanpur, India
Adviser: Prof. N.V. Reddy | May 2008 |
| B.Tech, Mechanical Engineering
<i>Vellore Institute of Technology</i> , Vellore, India | June 2006 |

POSITIONS HELD

- | | |
|---|----------------------|
| Assistant Professor, tenure-track
Department of Mechanical Engineering
<i>Oregon State University</i> | Sept. 2014-present |
| Assistant Professor, non tenure-track
Department of Mechanical Engineering
<i>Oregon State University</i> | Dec. 2013-Sept. 2014 |
| Research Associate,
<i>Northwestern University</i> , Evanston, IL | Aug. 2012-Dec.2013 |
| Postdoctoral Fellow,
<i>Northwestern University</i> , Evanston, IL | June-Aug. 2012 |

Research Intern,
Ford Motor Company,
Research and Advanced Engineering Center

July-Sept. 2009, 2010

REFEREED PUBLICATIONS (Students supervised at OSU marked as *)

Journal Publications

1. *Bansal, S., **Malhotra, R.**, 2016, "Nanoscale-Shape-Mediated Coupling between Densification and Temperature Evolution in Intense Pulsed Light Sintering", *IOP Nanotechnology*, 27(49), 16 pages.
2. *Davarpanah, M.A., *Bansal, S., **Malhotra, R.**, 2016, "Influence of Single Point Incremental Forming on Mechanical Properties and Microstructural Morphology of Polymers", *ASME Journal of Manufacturing Science and Engineering, In Press*.
3. *Davarpanah, M.A., Zhang, Z., *Bansal, S., Cao, J., **Malhotra R.**, 2016, "Preliminary Investigations on Double Sided Incremental Forming of Thermoplastics", *SME Manufacturing Letters*, 8, pp. 21-26.
4. Irrinki, H., *Dexter, M., Barmore, B., Enneti, R., Pasebani, S., Badwe, S., Stitzel, J., **Malhotra, R.**, Atre, S.V., 2016, "Effects of Powder Attributes and Laser Powder Bed Fusion (L-PBF) Process Conditions on the Densification and Mechanical Properties of 17-4 PH Stainless Steel", *JOM Journal of the Minerals, Metals & Materials Society (TMS)*, 68 (3), pp. 860-868.
5. Kim, K-J, *Bansal, S., Kim, D-H, Chang, C-H, **Malhotra, R.**, "Scalably synthesized aqueous-based binary nanoparticle inks for $\text{Cu}_2\text{ZnSn}(\text{S},\text{Se})_4$ photovoltaic cells achieving over 9% efficient without an anti-reflective coating", *Submitted to RSC Sustainable Energy & Fuels.*, November 2016.
6. *Davarpanah, M.A., Mirkouie, A., Yu, X., **Malhotra, R.**, Pilla, S., 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, pp. 287-300.
7. *MacNeill, W.D., Choi, C-H, Chang, C-H, **Malhotra, R.**, 2015, "On the Self-Damping Nature of Densification in Photonic Sintering of Nanoparticles", *Nature Scientific Reports*, 5, 14845-13 pages.
8. Zhang, Z., Ren, H., Xu, R., Moser, N., Smith, J., Ndip-Agbor, E., **Malhotra, R.**, 2015, "A Mixed Double-Sided Incremental Forming Toolpath Strategy for Improved Geometric Accuracy", *ASME Journal of Manufacturing Science and Engineering*, 137 (5), 051007-7 pages.
9. Saxena, I., **Malhotra, R.**, Ehmann, K., Cao, J., 2015, "High-Speed Fabrication of Microchannels Using Line-Based Laser Induced Plasma Micromachining", *ASME Journal of Micro and Nano-Manufacturing*, 3 (2), pp. 021006-8 pages.

10. Xu, R., Shi, X., Xu, D., **Malhotra, R.**, Cao, J., 2014, “A Preliminary Study on the Fatigue Behavior of Sheet Metal Parts Formed with Accumulative Double-sided-incremental forming”, *SME Manufacturing Letters*, 2, pp. 8-11.
11. **Malhotra, R.**, Saxena, I., Ehmann, K., Cao, J., 2013, “Laser-induced Plasma Micro-machining (LIP-MM) for Enhanced Productivity and Flexibility in Laser-based Micro-machining Processes”, *CIRP Annals-Manufacturing Technology*, 62(1), pp. 211-214.
12. Smith, J., **Malhotra, R.**, Cao, J., Liu, W.K, 2013, “Deformation Mechanics in Single-Point and Accumulative Double-Sided Incremental Forming”, *International Journal of Advanced Manufacturing Technology*, 69(5), pp. 1185–1201.
13. Beltran, M., **Malhotra, R.**, Nelson, A.J., Cao, J., Bhattacharya, A., Reddy, N.V., 2013, “Experimental Study of Failure Modes and Scaling Effects in Micro-Incremental Forming”, *ASME Journal of Micro and Nano Manufacturing*, 1(3), 15 pages.
14. X. Dongkai, Wu, W., **Malhotra, R.**, Chen, J., Lu, B., Cao, J., 2013, “Mechanism Investigation for the Influence of Frictional Heat and Laser Surface Texturing on Formability in Single Point Incremental Forming”, *International Journal of Machine Tools and Manufacturing*, 73, 37-46.
15. **Malhotra, R.**, Xue, L., Belytschko, T. and Cao, J., 2012, “Mechanics of Fracture in Single Point Incremental Forming”, *Journal of Materials Processing Technology*, 212 (1), pp. 1573-1590.
16. **Malhotra R.**, Cao, J., Beltran, M., Xu, D., Magargee, J., Kiridena, V., Xia, Z.X., 2012, “Accumulative-DSIF Strategy for Enhancing Process Capabilities in Incremental Forming”, *CIRP Annals-Manufacturing Technology*, 61(1), pp. 251-254.
17. Dongkai, X., **Malhotra, R.**, Reddy, N.V., Chen, J., Cao, J., 2012, “Analytical Prediction of Stepped Feature Generation in Multi-pass Single Point Incremental Forming”, *SME Journal of Manufacturing Processes*, 14, pp. 487–494.
18. **Malhotra, R.**, Bhattacharya, A., Kumar, A., Reddy, N.V. and Cao, J., 2011, “A New Methodology for Multi-Pass Single Point Incremental Forming”, *CIRP Annals-Manufacturing Technology*, 60(1), pp. 323-326.
19. **Malhotra, R.**, Cao, J., Ren, F., Kiridena, V., Cedric Xia, Z. and Reddy, N.V., 2011, “Improvement of Geometric Accuracy in Incremental Forming by using a Squeezing Toolpath Strategy with Two Forming Tools”, *ASME Journal of Manufacturing Science and Engineering*, 133 (6), 061019-10 pages.
20. **Malhotra, R.**, Reddy, N.V. and Cao, J., 2010, “Automatic Helical Toolpath Generation for Single Point Incremental Forming”, *ASME Journal of Manufacturing Science and Engineering*, 132 (6), 061003-10 pages.

Conference Publications

1. *Bansal, S., **Malhotra, R.**, “The Coupling between densification and optical heating in intense pulsed light sintering of silver nanoparticles”, *ASME Manufacturing Science and Engineering Conference 2016*, Blacksburg, Virginia, USA.

2. *Darvapanah, M.A., *Bansal, S., **Malhotra, R.**, “Mechanical properties and chain orientation in single point incremental forming of semicrystalline polyamide”, *ASME Manufacturing Science and Engineering Conference 2016*, Blacksburg, Virginia, USA.
3. *Davarpanah, M.A., **Malhotra, R.**, 2015, "Effect of incremental depth and part shape on failure modes in single point incremental forming of polymers", *ASME Manufacturing Science and Engineering Conference 2015*, June 8-12, Charlotte, North Carolina, USA.
4. Xu, R., Ren, H., Zhang, Z., **Malhotra, R.**, Xia, Z.C., Cao, J., “A mixed toolpath strategy for improved geometric accuracy and higher throughput in double-sided incremental forming”, *ASME Manufacturing Science and Engineering Conference 2014*, Detroit, MI, USA.
5. Ndip-Abgor, E.E., Smith, J., Xu, R., **Malhotra, R.**, Cao, J., "Effect of relative tool position on geometric accuracy of Accumulative DSIF", *International Conference and Workshop on Numerical Simulation of 3D Sheet Metal Forming Processes 2014*, Melbourne, Australia.
6. Smith, J., **Malhotra, R.**, Liu, W.K., Cao, J., "Application of a shear-modified GTN model to Incremental Sheet Forming", *International Conference and Workshop on Numerical Simulation of 3D Sheet Metal Forming Processes 2014*, Melbourne, Australia.
7. **Malhotra, R.**, Saxena, I., Ehmann, K., Cao, J., “Line-based laser induced plasma micro-machining (L-LIPMM)”, *ASME Manufacturing Science and Engineering Conference 2013*, Wisconsin, Madison, USA.
8. Saxena, I., **Malhotra, R.**, Ehmann, K., Cao, J., "High-speed fabrication of micro-channels using Line-based Laser Induced Plasma Micromachining (L-LIPMM)", *International Conference on MicroManufacturing 2013*, University of Victoria.
9. Xu, D., **Malhotra, R.**, Chen, J., Lu, B., Cao, J., "Numerical and experimental studies for the effects of through-the-thickness shear on formability in single point incremental forming", *International Conference on Numerical Methods in Industrial Forming Processes 2013*, Shenyang, China.
10. Xu Dong-Kai, **Malhotra, R.**, Cao, J., Reddy, N.V., Chen, J., “Analytical prediction of stepped feature generation in Multi-pass Single Point Incremental Forming”, *Proceedings of the North American Manufacturing Research Conference of SME 2012*, South Bend, Indiana.
11. **Malhotra, R.**, Xue, L., Cao, J. and Belytschko, T., “Identification of deformation mechanisms responsible for failure in incremental forming using a damage based fracture model”, *International Conference and Workshop on Numerical Simulation of 3D Sheet Metal Forming Processes 2011*, Seoul, South Korea.
12. **Malhotra, R.**, Xue, L., Cao, J., Belytschko, T., Smith, K. Scott., Ziegert, J., “Prediction and analysis of fracture in Single Point Incremental Forming using a damage based material model”, *Proceedings of the North American Manufacturing Research Conference of SME 2011*, Corvallis, Oregon, USA.
13. **Malhotra, R.**, Cao, J., Ren, F., Kiridena, V., Xia, Z. Cedric., “Improvement of geometric accuracy in incremental forming by using a squeezing toolpath with two forming tools”, *ASME Manufacturing Science and Engineering Conference 2011*, Corvallis, Oregon, USA.

14. **Malhotra, R.**, Xue, L., Cao, J., “Fracture based formability prediction in Incremental Forming”, *ASME Manufacturing Science and Engineering Conference 2010*, Erie, PA, USA.
15. **Malhotra, R.**, Huang, Y., Xue, L., Cao, J., Belytschko, T., “An investigation on the accuracy of numerical simulations for Single Point Incremental Forming with continuum elements”, *International Conference on Numerical Methods in Industrial Forming Processes 2010*, Pohang, South Korea.
16. Wu, W., Huang, Y., **Malhotra, R.**, Wang, Y., Cao, J., “Experimental and Numerical Analysis of Titanium Micro Tube Elliptical Flaring”, *ASME International Manufacturing Science and Engineering Conference 2010*, Erie, PA, USA.
17. **Malhotra, R.**, Reddy, N.V., Cao, J., “Automatic tool path generation for Single Point Incremental Forming”, *ASME Manufacturing Science and Engineering Conference 2008*, Northwestern University, Evanston, IL, USA.
18. Cao, J., Huang, Y., Reddy, N.V., **Malhotra, R.**, Wang, Y., “Incremental Sheet Metal Forming: Advances and Challenges”, *International Conference on the Technology of Plasticity 2008*, Gyeongju, South Korea.

INTELLECTUAL PROPERTY

1. **Malhotra, R.**, Cao, J. “System and Method for Accumulative Double Sided Incremental Forming”, Patent No. US20130103177 A1, awarded 2015.
2. Cao, J, Ehmann, K.F., Pallav, K., **Malhotra, R.**, Saxena, I., 'Laser Induced Plasma Micromachining (LIPMM)', Patent No. US 20150294840 A1, awarded 2016.

BOOK CHAPTERS

Cao, J. and **Malhotra R.**, “Energy Reduction in Manufacturing via Incremental Forming and Surface Microtexturing” in *Energy Efficient Manufacturing with Applications*, 2017, Wiley, ISBN-13: 978-1118423844

INVITED PRESENTATIONS

1. “Process Science Driven Innovation in Manufacturing”, Department of Mechanical Engineering, University of Louisville Kentucky, October 2015.
2. “Deformation Mechanics & Process Innovation in Incremental Forming for Sustainable Manufacturing”, Georgia Institute of Technology, Department of Mechanical Engineering, February 2012.
3. “Deformation Mechanics & Process Innovation in Incremental Forming”, University of Florida, Department of Mechanical Engineering, February 2012.
4. “Fundamentals & Process Innovation in Incremental Forming for Sustainable Manufacturing”, Rutgers University, Department of Mechanical and Aerospace Engineering, March 2012.

GRANTS AND SPONSORED PROGRAMS

1. NSF CMMI #1537196: “Additive Manufacturing of Conformal Solar Cells via Xenon-Light-Assisted Sintering”; Total team funding: \$299,999; PIs funding: **\$194,206**; Period: 8/1/2015-7/31/2018; Lead PI: **Rajiv Malhotra**; Co-PI: Chih-hung Chang (OSU).
2. NSF CBET #1449383: “SNM: Physics Guided Innovation of Integrated Flash-Light-Sintering, Continuous Nanomaterial Synthesis and Roll-To-Roll Deposition Processes”; Total team funding: \$1,510,000; PIs funding: **\$429,983**; Period: 12/1/2014-11/30/2018, Lead PI: Chih-hung Chang (OSU), Co-PIs: **Rajiv Malhotra**; Alan Wang, Gregory Herman at OSU.
3. DOE Nuclear Energy University Programs: “Model Calibration-based Design Methodologies for Structural Design of Supercritical CO₂ Compact Heat Exchangers under Sustained Cyclic Temperature and Pressure Gradients”; Total team funding: \$800,000; PIs funding: **\$180,000**; Period: 10/1/2016-01/03/2019; Lead PI: Christopher Hoyle (OSU); Co-PIs: **Rajiv Malhotra**, Brian Paul (OSU), Hailei Wang (OSU), Omer Dogan (NETL).
4. DOE CSP APOLLO: “High-flux Microchannel Receiver Development”; Total team funding: \$2,000,000; PIs funding: **\$210,376**, Period: 10/1/2015-04/30/2017, Lead PI: Kevin Drost (OSU); Co-PIs: **Rajiv Malhotra**, Sourabh Apte (OSU), Brian Fronk (OSU), Brian Paul (OSU), Omer Dogan (NETL), Vinod Narayanan (UC Davis), Hailei Wang (OSU).
5. Walmart Manufacturing Innovation Grant: “Environmentally conscious dyeing of fabrics using continuous digital printing and drying of Biopigment inks”; Total team funding: \$810,466; PIs funding: **\$249,833**; Period: 1/21/2016-1/31/2019, PI: Chih-hung Chang; Co-PIs: **Rajiv Malhotra**, Sara Robinson, Hsiou-Lien Chen at OSU.
6. Walmart Manufacturing Innovation Grant: “New Additive Manufacturing Paradigms for Low Cost Injection Molding Tools”; Total team funding: \$593,065; PIs funding: **\$292,891**; Period: 10/1/2014-09/30/2017, PI: **Rajiv Malhotra**; Co-PI: Sundar Atre at University of Louisville Kentucky.
7. Oregon Nanoscience and Nanotechnologies Institute gap grant: “Next generation active no-fog applications”, Total team funding: \$99,999; PIs funding: **\$15,934**, Period: 03/02/2016-08/31/2017; PI: Chih-hung Chang (OSU) and ABOM Inc.; Co-PI: **Rajiv Malhotra**, Gregory Herman (OSU).
8. Oregon Metals Initiative: “Investigation of Electrically-assisted Subtractive Processes (ESP) for Metals”, Total team funding: \$200,000; PIs funding: **\$100,000**, Period: 01/01/2014-01/01/2015; PI: **Rajiv Malhotra**; Co-PI: Karl Haapala (OSU).

SERVICE

Organization of Professional Meetings

Chair and organizer for symposium on <i>Innovations in Material Forming</i> (2016-2017) at the ASME Manufacturing Science and Engineering Conference (MSEC).	2016-2017
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Rajiv Malhotra: CV

Chair and organizer for symposium on *Scalable Nanomanufacturing* (2015-2017) at the ASME Manufacturing Science and Engineering Conference (MSEC). 2016-2017

Chair and organizer for symposium on *Micromanufacturing Processes* at the International Conference on Micro and Mini-channels (ICNMM). 2015

Editorship

Guest editor for ASME Journal of Manufacturing Science and Engineering Special Issue on Innovations in Material Forming. 2016

Guest editor for ASME Journal of Micro-Nano Manufacturing Special Section on Scalable Nanomanufacturing. 2016

Reviewer

ASME Journal of Manufacturing Science and Engineering
Journal of Materials Processing Technology
CIRP Annals-Manufacturing Technology
SME journal of Manufacturing Processes
Mechanics of Materials 2011-2016
Journal of Materials Science
Machining Science and Technology
MSEC/NAMRC

National Science Foundation MME Proposal Reviewer 2015

Institutional

Mechanical Engineering Graduate Programs Committee, OSU 2016
Graduate recruitment organizer for advanced manufacturing area, OSU 2015
Faculty Search Committee Member, OSU 2015
Thesis committee member: 5 PhD students 2014-2016

TEACHING EXPERIENCE

MfgE 599: Physics-Based Modeling of Manufacturing Processes Spring 2016

MfgE 599: Micromanufacturing Process and Machines Fall 2014, 2015

ME 383: Design of Machine Elements Spring 2016

ME 511: Precision Machine Tool Design (Spring 2016) Spring 2015, 2016

STUDENT ADVISING

Current Graduate Students

<i>Student name</i>	<i>Expected Graduation</i>
○ Roshan Bhandari (M.S. with thesis) <i>Project:</i> Integration of large-area aerosol jet printing with flash light sintering on a desktop platform	Fall 2016
○ Michael Dexter (M.S. with thesis) <i>Project:</i> Combining xenon light sintering with a Digital Micromirror Device for desktop Additive Manufacturing of patterned microstructures with nanoparticles.	Spring 2018
○ Elham Mirkoohi (M.S. with thesis) <i>Project:</i> Molecular dynamics investigations of sintering in multimaterial, multishape nanoparticles.	Spring 2018
○ Mohammad Ali Davarpanah (PhD) <i>Project:</i> Physics-based modeling of deformation and failure in Double Sided Incremental Forming of polymers at room temperature.	Fall 2018
○ Shalu Bansal (PhD) <i>Project:</i> Investigating the coupling between optical absorption and sintering during Intense Pulsed Light sintering of nanoparticles.	Fall 2019
○ William Henry Pratte (PhD) <i>Project:</i> Structural design of compact heat exchangers under sustained cyclic temperature and pressure gradients	Fall 2020

Previous Graduate Students

○ William Macneill	M.S., June 2015
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Undergraduate Students

○ Scott Lindbloom (senior)	02/2014-01/2015
○ James Wilson Galung (senior)	09/2015-03/2016
○ Jose De Jesus Toledo (freshman)	03/2016-present
○ Erich Trickel (junior)	06/2016-present

High School Students

○ Scott Acker	06/2014-09/2014
○ Sara Maddox	06/2015-08/2016
○ Marley DeBrito	06/2016-present

HONORS AND AWARDS

Best poster award, North American Deep Drawing Research Group, spring symposium, May 2012, “Fundamental investigations in Incremental Forming for sustainable and flexible forming”.

Best presentation award, North American Manufacturing Research Conference, 2011, “Prediction and Analysis of Fracture in Single Point Incremental Forming using a Damage based Material Model”.

Best paper runner up, North American Manufacturing Research Conference, 2011, “Prediction and Analysis of Fracture in Single Point Incremental Forming using a Damage based Material Model”, Xue, L., Cao, J., Belytschko, T., Smith, K.S. and Ziegert, J.

Predictive Science and Engineering Design Cluster (PSED) fellowship, Northwestern University, 2010.

Murphy Graduate Fellowship, Northwestern University, 2008.

Indo-US Center for Research Excellence visiting scholar, IIT Kanpur, 2008.