JIAN CAO

Cardiss Collins Professor
Mechanical Engineering
Materials Science and Engineering (by courtesy)
Civil and Environmental Engineering (by courtesy)

Director, Northwestern Initiative on Mfg Science & Innovation

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Prof. Cao's major research interests include innovative manufacturing processes and systems, particularly in the areas of deformation-based processes, laser additive, and laser subtractive processes. Her work has made fundamental contributions to the characterization of material behavior and the relationships between manufacturing processes and resulting material/part performances. Her research has integrated analytical and numerical simulation methods, control and sensors, design methodologies, and machine learning to advance manufacturing processes and systems. Prof. Cao's research group has designed unique manufacturing equipment for dieless sheet forming, microforming, and additive manufacturing. Current research has direct impacts on energy-efficient manufacturing, surface engineering, and distributed manufacturing. Prof. Cao has published over 400 technical articles, including over 260 journal articles, 10 book chapters, and about 20 patents. She has given over 170 invited talks and published op-ed articles.

Prof. Cao's research contributions have been recognized extensively by her peers in the fields of manufacturing, applied mechanics and control. She is an elected member of the *National Academy of Engineering (NAE)* and an elected member of the *American Academy of Arts and Sciences* (*AAA&S*), a Fellow of the *American Association for the Advancement of Science* (AAAS), the *International Academy for Production Engineering (CIRP)*, the *Society of Manufacturing Engineers (SME)*, and the *American Society of Mechanical Engineers (ASME)*. Her major awards include the inaugural ASME DeVor-Kapoor Manufacturing Medal, the ASME Milton Shaw Manufacturing Research Medal; the SME Gold Medal; the DoD Vannevar Bush Faculty Fellowship; the ASME and Pi Tau Sigma Charles Russ Richards Memorial Award; the SME Frederick W. Taylor Research Medal; the ASME Blackall Machine Tool and Gage Award (twice); the ASME Ted Belytschko Applied Mechanics Award, ASME/AMD Thomas Hughes Young Investigator Award; and the NSF Early CAREER award. Prof. Cao is the Editor-in-Chief of the *Journal of Materials Processing Technology* and was the founding Technical Editor of the ASME *Journal of Micro- and Nano-manufacturing*. In 2012, she was selected to be the panelist representing the field of manufacturing in the World Technology Evaluation (WTEC) study on Societal Convergence for Human Progress: Beyond Convergence of Nano-Bio-Info-Cognitive Technologies, sponsored by NSF, NIH, NASA, EPA, DoD, and DoA.

Prof. Cao is the founding director of the Northwestern Initiative for Manufacturing Science and Innovation (NIMSI), a university research center aiming to undertake research and education initiatives associated with the broad spectrum of manufacturing related both to computational design and manufacturing and to emerging hyper-customized and personalized manufacturing. 24 faculty have been funded on NIMSI extramural grants with a total award amount of $17M since 2015. She leads Research activities for the NSF Engineering Research Center: Hybrid

Autonomous Manufacturing, Moving from Evolution to Revolution (ERC-HAMMER), which is a large five-institutional collaboration led by the Ohio State University. Prof. Cao is a member of the Technical Advisory Board of the National Manufacturing Institute's MxD, previously known as the Digital Manufacturing and Design Innovation Institute (DMDII).

Prof. Cao has been active on national and international stages. She served as the Program Director of the Materials Processing and Manufacturing (MPM) program at NSF from 2003 to 2005. During that short two-year period, under her leadership, the WTEC Study on Micro-manufacturing was conducted and co-sponsored by four government agencies (NSF, DoD, DOE, NIST) and more than ten NSF programs. She co-initiated the joint-funding between NSF and DOE for her MPM program. Through collaboration with other programs, she was able to increase funding for her program by over 20%. She is one of the main driving forces behind the well-received NSF workshops on CAREER development. Prof. Cao has served as President of the North American Manufacturing Research Institute of SME, Chair of ASME's Manufacturing Engineering Division, and Chair of the Scientific and Technical Committee on Forming for *CIRP*. She has chaired multiple ASME committees, including the Technical Committee on Publications and Communications, the M. Eugene Merchant Medal Committee, the Ehmann Manufacturing Medal Committee, and the Committee of Administration and Finance. She was awarded the ASME Dedicated Service Award. Prof. Cao was an invited speaker at the workshops on additive manufacturing in 2018 and a committee member of the Convergent Manufacturing Platform workshop in 2021 organized by the National Academies. Prof. Cao now serves on the National Materials and Manufacturing Board of the National Academies, Board of Directors of SME, Board of mHUB – accelerator for hardtech innovation and manufacturing in Chicago, and a member of the National Academies' consensus study "Option of A National Plan for Smart Manufacturing" sponsored by DOE.

Prof. Cao has served as an Associate Vice President for Research at Northwestern University since 2012 with a short break from 2021 to 2023 as the Chair of the Office for Research Advisory Council (ORAC). During her term, she oversees the unit that administers the university's core facilities. Working with faculty, staff and leadership at school-level and university-level, she successfully launched new funding models for key scientific instruments and software, and led initiatives for strengthening major supporting units, such as the machine shop, electronics shop and clean rooms. She also oversees University Research Centers and Institutes and facilities cross-school collaborations and internal research initiatives. Prof. Cao has contributed to the collaboration between the physical sciences and engineering, as well as with other disciplines across and beyond NU.

PROFESSIONAL EXPERIENCES

Associate Vice President for Research, Northwestern University	Sept. 2023 – present
Professor, Materials Science and Engineering (by courtesy)	Sept. 2018 – present
Cardiss Collins Professor, Northwestern University	Sept. 2016 – present
Professor, Mechanical Engineering, Northwestern University	Sept. 2008 – present
Director, Northwestern Initiative for Manufacturing Science and Innovation (NIMSI)	April 2015 – present
Senior Institute Fellow, Argonne National Laboratory	March 2016 – present
Founder, Scimplicity LLC	Nov. 2011 – Jan. 2023
Associate Vice President for Research, Northwestern University	Oct. 2012 – Aug. 2021
Co-Director, NSF Summer Institute on Nanomechanics,	

Nanomaterials, and Micro/Nanomanufacturing	Oct. 2007 – Sept. 2013
Director, Graduate Studies, Mechanical Engineering	Sept. 2007 – Sept. 2012
Professor, Civil and Environmental Engineering (by courtesy)	May 2010 – present
Associate Professor, Mechanical Engineering, Northwestern Univ.	Sept. 2002 – Aug. 2008
Interim Asso. Chair, Mechanical Engineering, Northwestern Univ.	Sept. 2006 – Aug. 2007
Program Director, National Science Foundation	Sept. 2003 – Sept. 2005
Assistant Professor, Mechanical Engineering, Northwestern Univ.	Sept. 1995 – Aug. 2002
Industrial training at General Motors Corp.	Sept. 1995 – June 1996
General Electric Assistant Chair Professor	Sept. 1996
Postdoctoral Fellow, Mechanical Engineering, M.I.T.	Feb. 1995 – July 1995

EDUCATION

Ph.D. Mechanical Engineering, *Massachusetts Institute of Technology*, 1995

M.S. Mechanical Engineering, *Massachusetts Institute of Technology*, 1992

B.S. Materials Science and Engineering, *Shanghai JiaoTong University*, 1989

B.S. Automatic Control, *Shanghai JiaoTong University*, 1989

HONORS AND AWARDS

2023	Inaugural DeVor-Kapoor Manufacturing Medal, ASME – for a body of impactful achievements in the field of manufacturing
2023	Member, American Academy of Arts and Sciences
2023	Ted Belytschko Applied Mechanics Award from the ASME Applied Mechanics Division
2022	Researcher to Know selected by Illinois Science & Technology Coalition
2022	SME NAMRC Outstanding Paper – “Data-driven prediction of next-layer melt pool temperatures in laser powder bed fusion based on co-axial high-resolution Planck thermometry measurements”
2022	Member, National Academy of Engineering
2020	ISFA Best Application Paper Award at the *ISFA* 2020 – “Kinematic Calibration and Data-Based Error Compensation of a Parallel Robot-Based Incremental Sheet Forming Machine”
2020	ASME Milton C. Shaw Manufacturing Research Medal – to recognize significant fundamental contributions to the science and technology of manufacturing processes.
2020	SME Gold Medal – to recognize outstanding service to the manufacturing engineering profession in technical communications through published literature, technical writings or lectures
2020	The 20 most influential professors in smart manufacturing, SME
2019	Vannevar Bush Faculty Fellow, *Department of Defense* – most prestigious and competitive single investigator research award by DoD
2019	Distinguished Achievement Team Award, *Department of Energy* EERE Vehicle Technologies Office – to recognize outstanding industry-university-government partnerships, with Ford, Dow Chemical and NIST.

2019	Fellow, *American Association for the Advancement of Science*
2018	*ASME* Blackall Machine Tool and Gage Award – Best Journal Paper Award "Pressure and Draw-in Maps for Stamping Process Monitoring"
2017	Charles Russ Richards Memorial Award, ASME and Pi Tau Sigma – to recognize outstanding achievement by an individual who graduated in mechanical engineering more than 20 years ago
2016	Frederick W. Taylor Research Medal, *Society of Manufacturing Engineers*
2014	Fellow, *The International Academy for Production Engineering (CIRP)*
2014	STLE Best Journal Paper Award, *Society of Tribologists and Lubrication Engineers* "Surface Texturing of Drill Bits for Adhesion Reduction and Tool Life Enhancement"
2014	ISFA Best Application Paper Award at the *ISFA* 2014 – "Design and evaluation of an embedded pressure sensor for microrolling process monitoring", Awaji-Island, Hyogo, Japan
2013	Distinguished Service Award, *ASME Manufacturing Engineering Division*
2012	*ASME* Blackall Machine Tool and Gage Award – Best Journal Paper Award "An Investigation on Deformation-based Micro Surface Texturing"
2011	*ASME* Dedicated Service Award
2010	Fellow, *Society of Manufacturing Engineers* (SME)
2009	Distinguished Service Award, *ASME Manufacturing Engineering Division*
2008	Best Poster Award, *ASME* Manufacturing Science and Engineering Conference, "Deformation Machining: A New Hybrid Process", Woody, B., Smith, K.S., Cao, J., Ziegert, J., Belytschko, T., Foecke, T. and Li, M
2007	Fellow, *American Society of Mechanical Engineers*
2006	Young Investigator Award, *American Society of Mechanical Engineers/Applied Mechanics*
2002	Outstanding Young Investigator Award, *Japan-US Flexible Automation*
2002	Outstanding Young Manufacturing Engineer Award, *Society of Manufacturing Engineers*
1999	Ralph R. Teetor Educational Award, *SAE International*
1997	Early CAREER Award, *National Science Foundation*
1997	ALCOA Foundation award, 1997

EDITORSHIPS

Member, Board of Reviewing Editors, *PNAS Nexus*, March 2023 – June 30, 2026.

Member, Editorial Committee, *CIRP Annals*, January 2021 – December 31, 2026.

Editor-in-Chief, *Journal of Materials Processing Technology*, Elsevier, January 2018 – December 31, 2023.

Founding Technical Editor, ASME *Journal of Micro- and Nano-Manufacturing (JMNM)*, January 2012 – December 2017.

Editor, *International Journal of Precision Engineering and Manufacturing*, Jan. 2011 – Dec. 2011

Associate Editor, ASME *Journal of Manufacturing Science and Engineering*, April 2003 – 2009

Associate Editor, ASME *Journal of Applied Mechanics*, October 2005 – October 2011

REFEREED JOURNAL ARTICLES (Google Scholar)

1. Choi, J.Y., Xue, T.J., Liao, S. and Cao, J. (2023) “Accelerating Phase-Field Simulation of Three-Dimensional Microstructure Evolution in Laser Powder Bed Fusion with Composable Machine Learning Predictions”, Additive Manufacturing, https://authors.elsevier.com/a/1iKPN7tcTWlOL7.
2. Shao, J., Samaei, A., Xue, T., Xie, X., Guo, S., Cao, J., MacDonald, E., Gan, Z. (2023) “Additive friction stir deposition of metallic materials: process, structure and properties”, Materials Design, https://doi.org/10.1016/j.matdes.2023.112356.
3. Jeong, J., Webster, S, Zha, R., Mogonye, J.E., Ehmann, K. and Cao, J. (2023) “Effects of Laser-Powder Alignment on Clad Dimension and Melt Pool Temperature in Directed Energy Deposition”, to appear ASME *J. Manufacturing Science and Engineering*.
4. Huang, D., Suarez, D., Kang, P., Ehmann, K., Cao. J. (2023) "Robot forming: automated English wheel as an avenue for flexibility and repeatability", Manufacturing letters, https://doi.org/10.1016/j.mfglet.2023.08.104.
5. Porter, C., Carter, F. M., Kozjek, D., Clark, S. J., Fezzaa, K., Mogonye, J. E., & Cao, J. (2023). “Qualitative analysis of potential pore healing phenomenon in L-PBF using operando high speed X-ray imaging,” *Manufacturing Letters*, https://doi.org/10.1016/j.mfglet.2023.08.052
6. Daehn, G., Cao, J., Lewandowski, J., Schmitz, T. and Sankar, J. (2023) "Introducing NSF's HAMMER Engineering Research Center: Hybrid Autonomous Manufacturing Moving from Evolution to Revolution [HAMMER]", JOM, 75, pages971–974 Published online March 2023, https://doi.org/10.1007/s11837-023-05765-y
7. Bernard, A., Kruth, J.P., Cao, J., Lanza, G., Bruschi, S., Merklein, M., Vaneker, T., Schmidt, M., Sutherland, J.W., Donmez, A. and da Silva, E. J. (2023) “Vision on metal additive manufacturing: Developments, challenges and future trends,”, *CIRP J. Mfg. Sci. Tech*., 47, pp. 18-58, https://doi.org/10.1016/j.cirpj.2023.08.005.
8. Tosello, G., Bissacco, G., Cao, J. and Axinte, D. (2023) “Modeling and simulation of surface generation in manufacturing”, *CIRP Annals*, Vol. 72(2), pp. 753-779, https://doi.org/10.1016/j.cirp.2023.05.002.
9. Xue, T., Liao, S., Gan, Z.T., Park, C., Xie, X., Liu, W.K. and Cao, J. (2023) “JAX-FEM: A differentiable GPU-accelerated 3D finite element solver for automatic inverse design and mechanistic data science”, *Computer Physics Communication*, Vol. 291, 108802, https://doi.org/10.1016/j.cpc.2023.108802.
10. Vazquez-Armendariz, J., Olivas-Alanis, L.H., Mahan, T., Rodriguez, C.A., Groeber, M., Niezgoda, S., Morris, J.M., Emam, H., Skoracki, R., Cao, J., Ripley, B., Iaquinto, J., Daehn, G. and Dean, D. (2023) “Workflow for Robotic Point-of-Care Manufacturing of Personalized Maxillofacial Graft Fixation Hardware”. *Integr Mater Manuf Innov*., Vol.12, 92-104, https://doi.org/10.1007/s40192-023-00298-3.
11. Webster, S., Moser, N., Fezzaa, K., Sun, T., Ehmann, K., Garboczi, E., Cao., J., (2023) “Pore formation driven by particle impact in laser powder-blown directed energy deposition”, *PNAS Nexus,* Vol. 2, 1-9, https://doi.org/10.1093/pnasnexus/pgad178.
12. Kozjek, D., Porter, C., Carter, F. M. III, Mogonye, J.-E., and Cao, J. (2023) "Data-driven prediction of geometry- and toolpath sequence-dependent intra-layer process conditions variations in laser powder bed fusion", *Journal of Manufacturing Processes,* Vol. 100, p. 34-46, https://doi.org/10.1016/j.jmapro.2023.05.021.

13. Webster, S., Jeong, J., Liao, S. and Cao, J. (2023) “Machine-agnostic Energy Density Model for Laser, Powder-blown Directed Energy Deposition”, *Journal of Manufacturing Processes*, Vol. 100, p.11-19, https://doi.org/10.1016/j.jmapro.2023.05.013.
14. Carter, F.M. III, Kozjek, D., Porter, C., Clark, S.J., Fezzaa, K., Fujishima, M. and Cao, J. (2023) “Melt Pool Instability Detection Using Coaxial Photodiode System Validated by in-situ X-ray Imaging”, *CIRP Annals*, Vol. 72(1), 205-208. https://doi.org/10.1016/j.cirp.2023.03.031.
15. Liao, S, Jeong, J., Zha, R., Xue, T. and Cao, J. (2023) “Simulation-guided Feedforward-feedback Control of Melt Pool Temperature in Directed Energy Deposition”, *CIRP Annals*, Vol. 72(1), 157-160. https://doi.org/10.1016/j.cirp.2023.03.014.
16. Cooper, C., Zhang, J., Huang, J., Bennett, J., Cao, J. and Gao, R.X. (2023) “Tensile Strength Prediction in Directed Energy Deposition Through Physics-Informed Machine Learning and Shapley Additive Explanations”, *J. Materials Processing Technology*., Vol. 315, 117908, https://doi.org/10.1016/j.jmatprotec.2023.117908.
17. Liao, S., Golgoon, A., Mozaffar, M. and Cao, J. (2023) “Efficient GPU-Accelerated Thermomechanical Solver for Residual Stress Prediction in Additive Manufacturing”, *Computational mechanics*, https://doi.org/10.1007/s00466-023-02273-3.
18. Kozjek, D., Porter, C., Carter, F.M., Bhattad, P., Brackman, P., Lisovich, A., Mogonye, J.K. and Cao, J. (2023) “Iterative Closest Point-based Data Fusion of Non-synchronized in-situ and ex-situ Data in Laser Powder Bed Fusion”, *Journal of Manufacturing Systems*, Vol. 66, p.179 – 199, https://doi.org/10.1016/j.jmsy.2022.12.007.
19. Mozaffar, M., Liao, S., Jeong, J., Xue, T. and Cao, J. (2023) “Differentiable Simulation for Material Thermal Response Design in Additive Manufacturing Processes”, *Additive Manufacturing*, https://doi.org/10.1016/j.addma.2022.103337.
20. Liao, S., Xue, T., Jeong, J., Webster, S., Ehmann, K. and Cao, J. (2023) “Hybrid thermal modeling of additive manufacturing processes using physics-informed neural networks for temperature prediction and parameter identification”, *Computational Mechanics*, https://doi.org/10.1007/s00466-022-02257-9.
21. Bisram, M., Ahmed, J., Hood, A and Cao, J. (2023) “A novel method for creation of complex microstructure cells through artificial molecular dynamics simulations”, *Composites Science and Technology*, 109849, https://doi.org/10.1016/j.compscitech.2022.109849.
22. Jeong, J., Webster, S., Liao, S., Mogonye, J.E., Ehmann, K. and Cao, J. (2022) “Cooling Rate Measurement in Directed Energy Deposition using Photodiode-Based Planck Thermometry (PDPT)”, *Additive Manufacturing Letters*, https://doi.org/10.1016/j.addlet.2022.100101.
23. Xue, T., Gan, Z., Liao, S. and Cao, J. (2022) “Physics-embedded graph network for accelerating phase-field simulation of microstructure evolution in additive manufacturing”, *npj Computational Materials*, https://doi.org/10.1038/s41524-022-00890-9.
24. Kafka, O.L., Yu, C., Cheng, P., Wolff, S. J., Bennett, J., Garboczi, E.J., Cao, J., Xiao, X. and Liu, W.K. (2022) “X-ray computed tomography analysis of pore deformation in IN718 made with directed energy deposition via in-situ tensile testing,” *Int. J. Solids and Structures*, Vol. 256, 11943, https://doi.org/10.1016/j.ijsolstr.2022.111943.
25. Leem, D., Liao, S., Bhandari, S., Wang, Z., Ehmann, K. and Cao, J. (2022) “A toolpath strategy for double-sided incremental forming of corrugated structures”, *J. Materials Processing Technology*, Vol. 308, 117727, https://doi.org/10.1016/j.jmatprotec.2022.117727.

26. Gao, J., Mojumder, S., Zhang, W., Li, H., Suarez, D., He, C., Cao, J. and Liu, W.K. (2022) "Concurrent n-scale modeling for non-orthogonal woven composite", *Computational Mechanics*, https://doi.org/10.1007/s00466-022-02199-2.
27. Liao, S., Webster, S., Huang, D., Council, R., Ehmann, K. and Cao, J. (2022) "Simulation-guided Variable Laser Power Design for Melt Pool Depth Control in Directed Energy Deposition", *Additive Manufacturing*, Vol. 56, 102912, https://doi.org/10.1016/j.addma.2022.102912.
28. Fang, L., Cheng, L., Glerum, J., Bennett, J., Dunand, D., Cao, J. and Wagner, G. (2022) "Data-driven analysis of process, structure, and properties of additively manufactured Inconel 718 thin walls", *npj Computational Materials*, Vol. 8:126, https://doi.org/10.1038/s41524-022-00808-5.
29. Bennett, J., Webster, S., Byers, J., Johnson, O., Wolff, S., Ehmann, K. and Cao, J. (2022) "Powder-borne porosity in directed energy deposition", *J. Manufacturing Processes*, Vol. 80, pp. 69-74, https://doi.org/10.1016/j.jmapro.2022.04.036.
30. Bhandari, S., Kang, P., Jeong, J., Cao, J. and Ehmann, K. (2022) "Cavitation bubble removal by surfactants in Laser-Induced Plasma Micromachining", Manufacturing Letters, Vol. 32, pp. 96-99, https://doi.org/10.1016/j.mfglet.2022.04.004.
31. Kozjek, D., Carter, F., Porter, C., Mogonye, J.E., Ehmann, K. and Cao, J. (2022), "Data-driven prediction of next-layer melt pool temperatures in laser powder bed fusion based on co-axial high-resolution Planck thermometry measurements", *J. Manufacturing Processes*, Vol. 79, pp.81-90, https://doi.org/10.1016/j.jmapro.2022.04.033.
32. Xie, J., Ehmann, K. and Cao, J. (2022) "MetaFEM: A Generic FEM Solver by Meta-expressions", *Comput. Methods Appl. Mech. Engrg.,* Vol. 394, 114907, https://doi.org/10.1016/j.cma.2022.114907.
33. Rout, S., Bisram, M. and Cao, J. (2022) 'Methods for Numerical Simulation of Knit Based Morphable Structures: KnitMorphs", *Scientific Reports*, 12:6630, https://doi.org/10.1038/s41598-022-09422-3.
34. Jiang, Z.L., Liao, S., Slocum, A.H., Leem, D., Ehmann, K.F. and Cao, J. (2022) "Toolpath planning for manufacturing of complex parts through incremental sheet forming", *ASME Open Journal of Engineering*, https://doi.org/10.1115/1.4053751.
35. Webster, S., Giovannini, M., Shi, Y., Martinez-Prieto, N., Fezzaa, K., Sun, T., Ehmann, K., and Cao, J. (2022) "High-throughput, In-situ Imaging of Multi-layer Powder-blown Directed Energy Deposition with Angled Nozzle", *Review of Scientific Instruments*, Vol.93(2), https://doi.org/10.1063/5.0077140.
36. Mozaffar, M., Liao, S.H., Xie, X.Y., Saha, S., Park, C., Cao, J. Liu, W.K. and Gan, Z. (2022) "Mechanistic Artificial Intelligence (Mechanistic-AI) for Modeling, Design, and Control of Advanced Manufacturing Processes: Current State and Perspectives", *J. Materials Processing Technology*, Vol. 302, https://doi.org/10.1016/j.jmatprotec.2021.117485.
37. Jiang, Z.L., Ehmann, K. and Cao, J. (2022) "Prediction of forming temperature in electrically-assisted double-sided incremental forming using a neural network", *J. Materials Processing Technology*, https://doi.org/10.1016/j.jmatprotec.2021.117486.
38. Mozaffar, M., Liao, S., Lin, H., Ehmann, K. and Cao, J. (2021) "Geometry-Agnostic Data-Driven Thermal Modeling of Additive Manufacturing Processes using Graph Neural Networks", *Additive Manufacturing*, 102449, https://doi.org/10.1016/j.addma.2021.102449.
39. Bruschi, S., Cao, J., Merklein, M. and Yanagimoto, J. (2021) "Forming of Metal-based Composites Parts", *CIRP Annals*, Vol. 70(2), https://doi.org/10.1016/j.cirp.2021.05.009.

40. Xie, X., Bennett, J., Saha, S., Lu, Y., Cao, J., Liu, W.K. and Gan, Z. (2021) “Mechanistic Data-driven Prediction of as-built Mechanical Properties in Metal Additive Manufacturing”, *npj Computational Materials*, Vol. 7, 86, https://doi.org/10.1038/s41524-021-00555-z.
41. Moser, N., Leem, D., Ehmann, K and Cao, J (2021) “A High-Fidelity Finite Element Model for Quantifying the Stress Triaxiality and Lode Angle Parameter in Double-Sided Incremental Forming”, *J. Materials Processing Technology*, Vol. 295, 117152, https://doi.org/10.1016/j.jmatprotec.2021.117152.
42. Bennett, J., Glerum, J. and Cao, J. (2021) “Relating additively manufactured part tensile properties to thermal metrics”, *CIRP Annals*, Vol. 70(1), pp. 187-190, https://doi.org/10.1016/j.cirp.2021.04.053.
43. Lindenmeyer, A., Webster, S., Zaeh, M., Ehmann, K. and Cao, J. (2021) “Template-Bayesian Approach for the Evaluation of Melt Pool Shape and Dimension of a DED-Process from In-Situ X-Ray Images”, *CIRP Annals*, Vol. 70(1), 183-186, https://doi.org/10.1016/j.cirp.2021.03.011.
44. Bennett, J., Liao, H.G., Buergel, T., Hyatt, G., Ehmann, K. and Cao, J. (2021) “Towards Bi-metallic Injection Molds by Directed Energy Deposition”, *Mfg. Letters*, Vol. 27, Pages 78-81. https://doi.org/10.1016/j.mfglet.2021.01.001.
45. Webster, S., Lin, H., Carter, F., Ehmann, K. and Cao, J. (2021) “Physical Mechanisms in Hybrid Additive Manufacturing: A Process Design Framework”, *J. Materials Processing Technology*, Vol. 291, 117048. https://doi.org/10.1016/j.jmatprotec.2021.117048.
46. Glerum, J., Bennett, J., Ehmann, K. and Cao, J. (2021) “Mechanical Properties of Hybrid Additively Manufactured Inconel 718 Parts Created via Thermal Control after Secondary Treatment Processes”, *J. Materials Processing Technology*, Vol. 291, 117047. https://doi.org/10.1016/j.jmatprotec.2021.117047.
47. Shi, Y, Cao, J. and Ehmann, K. (2020) "Generation of Surfaces With Isotropic and Anisotropic Wetting Properties by Curved Water Jet-Guided Laser Micromachining", ASME J. Micro- and Nano-manufacturing, Vol. 8, 041001.
48. Xie, J., Ehmann, K. and Cao, J. (2020) “Simulation of Ultrashort Laser Pulse Absorption at the Water-Metal Interface in Laser-Induced Plasma Micro-Machining (LIPMM)”, ASME *J. of Micro- and Nano-Manufacturing*, https://doi.org/10.1115/1.4049360.
49. Cheng, P., Liu, W. K., Ehmann, K. and Cao, J. (2020) “Enumeration of Additive Manufacturing Toolpaths Using Hamiltonian Paths”, *Mfg. Letters*, Vol. 26, 29-32, https://doi.org/10.1016/j.mfglet.2020.09.008.
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51. Cao, J. and Banu, M. (2020) “Opportunities and Challenges in Metal Forming for Lightweighting: Review and Future Work”, ASME *J. Manufacturing Science and Engineering*, Vol. 142, 110813, https://doi.org/10.1115/1.4047732.
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53. Liao, S., Zeng, Q., Ehmann, K. and Cao, J. (2020) “Parameter identification and non-parametric calibration of the Tri-pyramid Robot”, *IEEE/ASME Transactions on Mechatronics*, Vol. 25(5), pp. 2309-2317, https://doi.org/10.1109/TMECH.2020.3001021.

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2. Cao, J., Lee, J.H. and Peshkin, M., 'Real-time Draw-in Sensors and Methods of Fabrication', U.S. Patent No. 6,769,280, August 3, 2004.
3. Cao, J., Swanson, A. and Davis, T. "Microforming Method and Apparatus," US Patent No 8,408,039 B2, April 2, 2013.
4. Smith, K. S., Woody, B., Ziegert, J. and Cao, J. 'Deformation Machining – A Hybrid Process', US Patent No. 8,545,142, Oct. 1, 2013.
5. Roth, J. and Cao, J. "Electrical-assisted Double Side Incremental Forming and Processes Thereof", US Patent No. 8,741,079 B2, June 3, 2014.
6. Cao, J., Zhou, R. and Ehmann, K "Desktop deformation-based micro surface texturing system", US Patent No. 8,905,748 B2, December 9, 2014.
7. Grzina, D. Rajesh, T., Cao, J., Wang, Q., Xia, Z. C., Ling, T.D., Liu, P. "Cutting Tools with Textured Surfaces," US Patent No. 9,144,845, September 29, 2015.
8. Malhotra, R. and Cao, J. "System and Method for Accumulative Double Sided Incremental Forming", US Patent No. 9,168,580, October 27, 2015.
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10. Zeng, Q., Ehmann, K.F. and Cao, J. "Tri-pyramid Robot: a novel 3-DOF translational parallel manipulator", No. 9,283,671 B2, March 15, 2016; US Patent No. 10,583,552, March 10, 2020.
11. Xia, Z. C., Cao, J., Wang, Q., Rajesh, T., Grzina, D., Ling, T.D., Liu, P. "Forming Tools having Textured Surfaces", US Patent No. 9,321,090 B2, April 26, 2016.
12. Pallav, K., Malhotra, R., Saxena, I. Ehmann, K.F. and Cao, J "Laser Induced Plasma Micromachining (LIPMM)", US Patent No. 9,455,127 B2, Sept. 27, 2016; US Patent No. 10,692,700, June 23, 2020.
13. Gao, R.X., Fan, Z. and Cao, J. "Methods and Apparatus for Monitoring Microrolling Processes Using Embedded Sensing", US Patent No. 9,500,540, November 22, 2016.
14. Cao, J., Zhou, R. and Ehmann, K "Desktop deformation-based micro surface texturing system", US Patent No. 9,688,015 B2, June 27, 2017, division of 8,905,748.
15. Yao, Y.W., Wang, X., Ulmer, M. and Cao, J. "Stress manipulated coating for figure reshape of optical substrates", US Patent No. 9,864,105 B2, Jan. 9, 2018; Divisional US Patent No. 10,274,644 B2, April 30, 2019.
16. Cao, J. and Roth, J. "Apparatus for Electrical-Assisted Incremental Forming and Process Thereof", US Patent No. 9,951,397, April 24, 2018.
17. Ndip-Agbor, E. E. and Cao, J. "An Automated Toolpath Generation Method for Double Sided Incremental forming of Three Dimensional Freeform Shapes from Sheets", US Patent No. 10,162,329, December 25, 2018.
18. Zeng, Q., Ehmann, K., Ng, M.K. and Cao, J. "Incremental rotary rolling mill and method', US Patent No. 11,077,477 B2, August 3, 2021.
19. Cao, J. Chen, J. Ehmann, K. and Zhang, H. "Method and Apparatus for Double-sided Incremental Flanging", No. 16/613,885, Nov. 15, 2019.

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20. Bennett, J., Cao, J. and Ehmann, K.F. "Systems and Methods for Global Thermal Control of Additive Manufacturing", 16/223,534, Dec. 18, 2017.
21. Yao, Y., Prieto, N.M., Machado, C., Cao, J. and Park, K.C. "Self-healing, Hydrophobic Composites and related Methods", 17/057,805, Nov. 23, 2020.

22. Ren, H.Q., Xie, J., Liao, S., Leem, D., Cao, J. and Ehmann, K.F. “In-situ Springback Compensation in Incremental Sheet Forming”, WO 2020/168211 A1, US 62/805759, August 20, 2020.
23. Kung, H.H., Park, K.C.K., Cao, J., Patankar, N.A., Ehmann, K.F., Bhandari, S., Machado, C.J., Jiang, Z., Zhao, T.Y. and Urgun-demirtas, M. “Foulant resistant surfaces for phase change heat” 18/061,048, June 8, 2023
24. Solomon, J. L., Wang, H. P., Blaski, B. J., Vasquez, V., Huang, L., Leem, D., & Cao, J. “Systems and methods for evaluating rigidity of angle bracket.” 17/538,560. June 1, 2023
25. Rout, S. K., Cao, J., & Bisram, M. R. "Systems and Methods for Dieless Composite Forming." *18/134,868*, December 21, 2023.

BOOK CHAPTERS

1. Huang, Tianyu, Marisa Bisram, Yang Li, Hongyi Xu, Danielle Zeng, Xuming Su, Jian Cao, and Wei Chen. "Mixed-Variable Concurrent Material, Geometry, and Process Design in Integrated Computational Materials Engineering." *Machine Learning in Modeling and Simulation*: 395.
2. The Minerals, Metals & Materials Society (TMS), Metamorphic Manufacturing: Shaping the Future of On-Demand Components (Pittsburgh, PA: TMS, 2019). Electronic copies available at www.tms.org/metamorphicmanufacturing, with Daehn, G., Allison, J., Bilitz, El., Bourne, D., Clarke, K., DeLoach Jr., J. J., Herderick, E., Lewandowski, J., Schmitz, T., Sizek, H., Tekkaya, A.E.
3. Bostanabad, R., Liang, B., Gao, J., Liu, W. K., Cao, J., Zeng, D., Su, X., Xu, H., Li, Y. and Chen, W., "Multiscale Simulation of Fiber Composites with Spatially-Varying Uncertainties", Uncertainty Quantification in Multiscale Materials Modeling, ed. Wang Y and McDowell, D., Elsevier S&T, 2018.
4. Cao, J. and Malhotra, R. (2018) Energy Reduction in Manufacturing via Process Innovation and Surface Modification, in Energy Efficient Manufacturing, Ed. Sutherland, J., Dornfeld, David A. and Linke, Barbara S., Wiley, ISBN 9781119519812 (pdf) | ISBN 9781119521372 (epub) | ISBN 9781118423844 (cloth).
5. Cao, J. Meador, M., Baba, M.L., Ferreira, P. M., Madou, M., Scacchi, W., Spohrer, R.J., Teague, C., Westmoreland, P., Zhang, X. (2014) Chapter 7: Implications: Societal Collective Outcomes, including Manufacturing, in *Convergence of Knowledge, Technology and Society*, Eds. Roco, M.C.; Bainbridge, W.; Tonn, B.; Whitesides, G., Springer, ISBN 978-3-319-02203-1.
6. Cao, J. and Ehmann, K. (2013) Section editor, Manufacturing Tribology, in *Encyclopedia of Tribology*, Ed. Wang, Q. and Chung, Y.W., Springer, ISBN 978-0-387-92896-8.
7. Cao, J., Chen, J. and Peng, X. (2011) Chapter 13: In-plane shear properties of woven fabric reinforced composites, in "Composite Reinforcements For Optimum Performance" Ed. Boisse, P., Woodhead Publishing Limited, ISBN-13: 978 1 84569 965 9.
8. Peng, X. and Cao, J. (2011) Chapter 8: Continuous models for analyzing the mechanical behavior of reinforcements in composites, in "Composite Reinforcements For Optimum Performance" Ed. Boisse, P., Woodhead Publishing Limited, ISBN-13: 978 1 84569 965 9.
9. Wang, Q., Zhu, D., and Cao, J. (2009) Chapter 26. Tribology and Surface Engineering, Scientific and Technological Bases for Energy Efficiency, in *Intelligent Energy Field Manufacturing and Interdisciplinary Process Innovations*, Ed. Zhang, W., CRC Press.

10. Ehmann, K.F., DeVor, R.E., Kapoor, S.G. and Cao, J. (2008) Chapter: Design and Analysis of Micro/Meso-scale Machine Tools, in *Smart Devices and Machines for Advanced Manufacturing*, Springer-Verlag London.
11. Philippe Boisse, Remko Akkerman, Jian Cao, Julie Chen, Stepan Lomov and Andrew Long, (2007) "Composites Forming" in *Advances in Material Forming (Esaform 10 Years on),* Springer, ISBN: 978-2-287-72142-7.
12. Cheng, H.S., Cao, J., Mahayotsanun, N. (2007) "Experimental Study on Behavior of Woven Composites in Thermo-stamping under Nonlinear Temperature Trajectories", *Advanced Methods in Material Forming*, ed. Dorel Banabic, Springer, ISBN: 978-3-540-69844-9.
13. Cao, J. (2007), *Preface*, "Micromanufacturing: International Assessment of Research and Development", Springer, ISBN: 1402059485, Ehmann, K. et al.
14. Gorczyca, J., Chen, J. and Cao J. (2007), *Composite Forming Technologies*, Woodhead Publishing Lt., Cambridge, UK., ISBN 1 84569 033 8.
15. Smith, L.M.; Zhang, L.; Wang, C.-T.; Shi, M.F.; Yoon, J.-W.; Stoughton, Th.B.; Cao, J.; Pourboghrat, F. (2005) Numerical Simulation of 3D Sheet Metal Forming Processes, American Institute of Physics, Melville, New York, ISBN: 978-0-7354-0265-2.
16. Cao, J. (2005) *The ASM Handbook (Volume 14) Chapter 16: Bending and Flanging, of Aluminum Sheet*, ASM International, ISBN: 1-892140-03-9.
17. Mahmoud Y. Demeri, Jian Cao and Ravi Venugopal (2005) *The ASM Handbook (Volume 14) Chapter 18: Process and Adaptive Control for Sheet Forming*, ASM International, ISBN:1-892140-03-9.

PUBLIC MEDIA

1. Malshe, A. Agonafer, D., Bapat, S. and Cao, J. (2021) A Case for Frugal Engineering and Related Manufacturing for Social Equity, *The Bridge*, National Academy of Engineering, Spring 2021, Vol. 51(1), https://www.nae.edu/File.aspx?id=250773.
2. Cao, J. (2017) Machinery investment, not trade agreements, are the problem with Asia, *The Hill,* http://thehill.com/opinion/international/360877-machinery-investment-not-trade-agreements-are-the-problem-with-asia.
3. Cao, J. (2018) – Manufacturing is an Integration Platform – and a Candy Store, *a radio interview at Women and Manufacturing*, http://womenandmfg.com/candy-store/?fl_builder.
4. Cao, J. (2018) - Finding the way to tariff-proof manufacturing, *The Hill*, http://thehill.com/opinion/technology/398380-finding-the-way-to-tariff-proof-manufacturing
5. Featured as one of the 28 women faculty in the 150th Years of Women at Northwestern celebration, www.northwestern.edu/150-years-of-women/catalysts/index.html#filter=.Faculty*
6. Manufacturing A Future – Beyond the Assembly Line, *Northwestern Research News*, June 14, 2019, https://www.research.northwestern.edu/manufacturing-a-future-beyond-the-assembly-line/.

CONFERENCE PUBLICATIONS (> 200)

INVITED PRESENTATIONS

1. Plenary Keynote, Advanced Manufacturing, ASME IMECE, Portland, November 17-21, 2024.
2. Plenary, "Machine Learning for Advancing Metal Processing Technologies", 2023 ICTP, International Conference on the Technology of Plasticity, September 24 – 29, 2023, Mandelieu la Napoule, Bay of Cannes, France.
3. Plenary, "Physics-Based AI-Assisted Numerical Simulations for Manufacturing Process Design and Control," the 17th U.S. National Congress on Computational Mechanics, Albuquerque, NM, July 23-27, 2023.
4. Panelist, Manufacturing Innovation, Chicagoland Chamber of Commerce, John Deere, Chicago, IL, May 23, 2023.
5. Baetjer Lecture, Princeton University, April 21, 2023.
6. Keynote, "AI for forming and additive manufacturing", SHEMET 2023, April 2 – 5th, 2023, Nuremberg, Germany.
7. Kavli Foundation Frontiers of Materials Lecture, MRS Fall meeting, November 29, 2022.
8. Fellows Lecture, Raytheon Technologies Research Center, November 22, 2022
9. Invited Seminar, Novelis Research Center, November 8, 2022.
10. Keynote, "Surface Engineering for Functionality – from Micro to Macro", 5th Congress on Micro and Nano Manufacturing, Leuven, Belgium, Sept. 19 – 22, 2022.
11. Speaker, S. M. Wu Distinguished Lectureship in Manufacturing Sciences, University of Michigan, September 9, 2022.
12. Keynote, "Material Property Control in Directed Energy Deposition", AM Bench 2022, NIST, Bethesda, MD, August 15 – 18, 2022.
13. Keynote, "The Role of Machine Learning in Manufacturing", 2022 Manufacturing Science Engineering Conference, Purdue, June 28, 2022
14. Panelist, Fireside Keynote Panel, NAMRC 50, Purdue, June 27 – July 1, 2022.
15. Invited Seminar, Boeing Distinguished Research and Scholar Seminar (B-DRASS), March 29, 2022.
16. Invited Seminar, Indian Institute of Technology, Kharagpur, March 5, 2022.
17. Keynote, 13th Asian Workshop on Micro/Nano Forming Technology & 3rd Asian Pacific Symposium on Technology of Plasticity (virtual), November 4, 2021.
18. Invited Seminar, Department of Materials Science and Engineering, University of California, Los Angeles, October 29, 2021.
19. Plenary, 2021 IACM Conference for Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering and Technology, Sept. 26 – 29, 2021, San Diego.
20. Invited Speaker, Female Researchers Chapter, 2021 U.S. National Congress on Computational Mechanics (virtual), July 27, 2021.
21. Keynote, 11th Brazilian Congress on Manufacturing Engineering (virtual), May 24, 2021.
22. Invited Seminar, Department of Mechanical Engineering, Massachusetts Institute of Technology, April 16, 2021.
23. Plenary, International ESAFORM Conference on Material Forming 2021, April 14, 2021.

24. Distinguished Seminar Speaker, Department of Mechanical Engineering, The University of Utah, March 5, 2021.
25. Invited Speaker, Women in STEM, Walter Payton College Prep in Chicago, Feb. 6, 2021.
26. Byron Short Lecture, The University of Texas, Austin, October 30, 2020.
27. Invited Panelist, Building Corporate Relationships, Northwestern University, October 28, 2020.
28. Invited Seminar, Center for Advanced Manufacturing, University of Southern California, Oct. 23, 2020.
29. Invited Seminar, Duke University, October 7, 2020.
30. Lindbergh Lecture, University of Wisconsin, Madison, September 10, 2020.
31. Invited Speaker, CIRP Japan meeting, December 9, 2019.
32. Invited Guest and Moderator, Tokyo Forum 2019 – Shaping the Future, December 6 – 8, 2019, University of Tokyo, Japan.
33. Invited Speaker, Agile - Metamorphic Manufacturing Workshop, LIFT, Detroit, Nov. 14, 2019.
34. Invited Speaker, Metamorphic Manufacturing – Incremental Deformation Processing for Agile, High-quality Metallic Component Production, Materials Science and Technology, Portland, Sept. 30, 2019.
35. Invited Seminar, Material characterization in metal forming, Daimler AG, Stuttgart, Germany, August 26, 2019.
36. Panelist, Encouraging Collision: Cultivating a Culture of Innovation in Large and Medium Corporations, mHUB, Chicago, March 14, 2019.
37. Inaugural Speaker of the Distinguished Seminar Series, Digital Manufacturing, Department of Mechanical Sciences and Engineering, University of Illinois, Urbana-Champaign, March 5, 2019.
38. Plenary Keynote, Manufacturing for X, ASME IMECE, Pittsburgh, November 9-15, 2018.
39. Invited Speaker, Modeling Challenges and Opportunities at the Part-Level, A Workshop on: The Frontiers of Mechanistic Data-Driven Modeling for Additive Manufacturing, The National Academy, Oct. 24-26, 2018, Fürth, Germany.
40. Keynote, From Dieless Forming to Smart Tooling, 5th International Conference on New Forming Technology (ICNFT), Sept. 19 – 21, 2018, Bremen, Germany.
41. Plenary, Advanced 3D Printing Processes, International Forum on MicroManufacturing, July 20-22, 2018, Toyama, Japan.
42. Keynote, Linking Thermal History to Mechanical Behavior in Directed Energy Deposited Materials, 75th Anniversary of SEM Annual Conference, February 26, 2018, Greensville, SC.
43. Invited Seminar, Manufacturing for X, Apple Inc., February 12, 2018.
44. Invited Seminar, The Art and Science of Flexible Sheet Metal Forming, The Ohio State University, January 23, 2018, Columbus, Ohio.
45. Keynote, Process-structure-properties Relationships of DED-processed Inconel 718, Plasticity 2018, Jan. 3 – 9, 2018, San Juan, PR.
46. Invited Seminar, The Art and Science of Flexible Sheet Metal Forming, JITRI, Nanjing, China, December 13, 2017.
47. Plenary Keynote, The Art and Science of Flexible Sheet Metal Forming, 12th International Conference on Technology of Plasticity, September 17-22, 2017, Cambridge, U.K.

48. Finalist, Manufacturing Process Compiler, NAMRC Blue Skype Competition, Los Angeles, June 2017.
49. Invited Talk, Additive Manufacturing, University of British Columbia, Vancouver, Jan. 2017.
50. Invited Speaker, Digital Manufacturing – what is it and how will it impact our world? NU Knowledge at Noon, April 5, 2016, Evanston, IL.
51. Invited Speaker, Advanced Manufacturing – Current Challenge in Computing Conference, March 29 – 31, 2016, Napa, CA.
52. Invited Speaker, Generis American Manufacturing Summit, February 29 – March 1, 2016, Chicago, Illinois, http://manufacturing.generisgp.com/summit/speakers
53. Invited Talk, Integration of Innovative Manufacturing Processes, Mechanics and Materials Design for Energy-efficient Distributed Manufacturing, December 15, 2015, University of Michigan, Ann Arbor.
54. Keynote, Digital Manufacturing, 12th Conference on Advanced Molding and Materials Processing, November 20, 2015, Nansha, China.
55. Keynote, Cope with Uncertainties in Sheet Metal Forming Processes – Classification and Methodologies, 2nd Int. Conf on Uncertainty in Mechanical Engineering, Nov. 19, 2015, Darmstadt, Germany.
56. Keynote, Advances in Modeling of Manufacturing Process, Society of Engineering Science Annual Technical Conference, Oct. 28 – 30, 2015, College Station, TX.
57. Invited Talk, Additive Manufacturing, NAS workshop, Oct. 7-9, 2015, Washington, D.C.
58. Invited Talk, "Digital Manufacturing for Flexibility and Energy Efficiency", DMDII Summer Institute on Sustainability and Energy, August 10, 2015, Chicago, IL.
59. Invited Talk, "Coupling Manufacturing, Mechanics and Materials Design in Additive Manufacturing", NSF Workshop on Multiscale/3D Printing Cement, July 16-17, Nashville, TN.
60. Plenary Talk, "Flexible Energy Efficient Sheet Metal Forming", International Deep Drawing Research Group 2015 Conference, Shanghai, China, June 1, 2015.
61. Invited Panelist, Advanced Manufacturing Workshop, University of Pennsylvania, May 21, 2015.
62. Department Seminar Speaker, Mechanical & Industrial Engineering, University of Iowa, May 7, 2015.
63. Invited Talk, "Opportunities and Challenges in Rapid Flexible Manufacturing", U.S. National Committee for Theoretical and Applied Mechanics, The National Academies, May 1, 2015.
64. Invited Seminar, "Challenges and Opportunities in Linking Materials, Processes and Performance", NIST, April 30, 2015.
65. Invited Speaker, Generis American Manufacturing Summit, March 10-11, 2015, Chicago, Illinois, http://manufacturing.generisgp.com/summit/speakers.
66. Panelist, "Reaping the Benefits of Corporate Sponsored Research: A Panel Discussion by McCormick Faculty", Northwestern University, Jan. 22, 2015.
67. Invited Lecturer "Flexible Energy-Efficient Manufacturing", Hong Kong Productivity Council, Oct. 13, 2014.
68. Plenary Talk, "Rapid Manufacturing Processes for Enhancing Energy Efficiency", International Conference on Advanced Aerospace Manufacturing, May 22-23, 2014, Shanghai, China.

69. Invited Department Seminar, Materials Science and Engineering, Carnegie Mellon, April 25, 2014.
70. Curie Lecture, University of Florida, Gainesville, February 18, 2014.
71. Plenary Talk “Microforming”, 2013 International Conference on Multi-Material Micro-Manufacture (4M2013), 8-10 October 2013, San Sebastian, Spain.
72. Keynote Talk, “Metal forming proc16th International Conference on Advances in Materials & Processing Technologies (AMPT 2013), Sept. 22 – 26, 2013, Taiwan.
73. Invited Talk “Eletroplasticity – Yes or No”, University of Ulsan, May 4, 2013, Ulsan, South Korea
74. Invited Talk “Manufacturing Aspects in Systems Engineering for Clean and Renewable Energy Manufacturing”, National Science Foundation, March 14, 2013, Arlington, VA.
75. Invited Talk “Converging Knowledge and Technologies for Societal Benefit - Implications: Societal collective outcomes, including manufacturing”, National Science Foundation, December 11, 2012, Arlington, VA.
76. Invited Seminar, “Material Design and Manufacturing”, Schlumberger, November 12, 2012, Houston, TX.
77. Keynote Talk “Small Features for Large Saving”, ISGMA 2012 International Symposium on Green Manufacturing and Applications, August 25-27, 2012, Jeju, Korea.
78. Invited Talk “Transforming the Landscape of Manufacturing”, WTEC Study on NBIC2, National Science Foundation, June 25, 2012.
79. Invited Seminar “Point-of-Need Manufacturing Processes for Enhancing Energy Efficiency”, University of Texas, Austin, April 10, 2012.
80. Invited Seminar “Point-of-Need Manufacturing Processes for Enhancing Energy Efficiency”, Texas A&M, College Station, Texas, April 11, 2012.
81. Invited Epstein Institute Seminar, “Point-of-Need Manufacturing Processes for Enhancing Energy Efficiency”, Department of Daniel J. Epstein Department of Industrial and System Engineering, University of Southern California, October 25, 2011.
82. Keynote Talk, “Engineering Energy-efficient Surfaces and Forming Processes”, ISGMA 2011 International Symposium on Green Manufacturing and Applications, October 6~7, 2011, Seoul, Korea.
83. Invited Talk, “Recent Findings in Incremental Forming”, Institute of Forming Technology and Lightweight Construction (IUL), Dortmund, Germany, August, 2011.
84. Invited Talk, “Surface Texturing: Theory, Fabrication Methods and Applications”, Institute of Forming Technology and Lightweight Construction (IUL), Dortmund, Germany, August, 2011.
85. Invited Talk, “Manufacturing Processes to Increase Energy Efficiency and Energy Independency”, March 15, 2011, Kansas State University.
86. Invited Talk, “Incremental forming at multi-scales”, Indo-US forum, Aurangabad, India, Dec. 17, 2010.
87. Keynote Talk, “Recent findings in microforming and its applications”, The 10th Asia-Pacific Conference on Engineering Plasticity and Its Applications, Wuhan, China, Nov. 15-17, 2010
88. Keynote Talk, “Micromanufacturing in Biomedical and Energy Applications”, International Forum on MicroManufacturing, Gifu, Japan, Oct. 21-23, 2010.
89. Keynote Talk, “An investigation on bump formation in forming of micro dimples”, Metal Forming 2010, Toyohashi, Japan, September 19-22, 2010.

90. Plenary Talk, “Manufacturing Processes to Increase Energy Efficiency and Energy Independency”, 9th International Conference on Frontiers of Design and Manufacturing, Changsha, China, July 17-20, 2010.
91. Association for Manufacturing Technology, “New Technology Developments in Japan”, 2010 Manufacturing Technology Forum, March 31, 2010, Nashville, TN.
92. NSF US-Egypt Wind Energy Workshop, “Understanding the Life of Power Transmission Elements of Wind Turbine Systems”, March 22-24, 2010, Cairo, Egypt.
93. Silgan, “Sheet Metal Forming Research at AMPL”, February 25, 2010, Wisconsin.
94. Naval Research Laboratory, “Material Formability and Geometry Flexibility in the Deformation Processes,” January 28, 2010.
95. India Institute of Technology, Kanpur, “Forming Processes and Surface Texturing in the Era of Energy Research”, December 10, 2009.
96. Argonne National Laboratory, Argonne, IL, “Surface Texturing in the Era of Energy Research”, November 18, 2009.
97. Shanghai Jiao Tong University, China, “Surface Texturing and Manufacturing Processes to Increase Energy Efficiency”, September 14 and September 15, 2009.
98. National Taiwan University, Taiwan, “Surface Texturing and Manufacturing Processes to Increase Energy Efficiency” & “Research at ME of Northwestern University”, July 13, 2009.
99. Chung Yuan Christian University, Taiwan, “Surface Texturing and Manufacturing Processes to Increase Energy Efficiency”, July 13, 2009.
100. NSF Energy Workshop, “Better efficiency by surface texturing”, June 21, 2009.
101. University of Minnesota, Twin City, “Surface Texturing and Manufacturing Processes to Increase Energy Efficiency”, April 1, 2009.
102. Society of Manufacturing Engineers Micromanufacturing Conference, “Microforming”, March 31, 2009.
103. University of Colorado, Boulder, “Material and Friction Characterization in Forming”, February 26, 2009.
104. University of Connecticut, “Material and Friction Characterization in Forming”, January 23, 2009.
105. India Institute of Technology, Kanpur, “Metal Forming: Process Innovation and Mechanics”, December 15, 2008.
106. Georgia Institute of Technology, “Material and Friction Characterization in Forming”, Oct. 24, 2008.
107. Shanghai Jiao Tong University, “Material and Friction Characterization in Forming”, Sept. 22, 2008.
108. Seoul National University, Department of Materials Science and Engineering, “Incremental Forming: Advances and Challenges”, Sept. 12, 2008.
109. Keynote Presentation, “Incremental Forming: Advances and Challenges”, International Conference on Technology of Plasticity, Gyeongju Korea, Sept. 11, 2008.
110. General Electric, “Surface Engineering and its Effect on Friction Control”, July 22, 2008.
111. Society of Manufacturing Engineers Micromanufacturing Conference, “Microforming”, April 21, 2008.
112. General Motors, “Integrated Sensing System for Stamping Monitoring and Control”, April 18, 2008.

113. University of North Carolina, Charlotte, “Mechanics and Control of Deformation Processes”, March 18, 2008.
114. University of California, Irvine, “Micromanufacturing and Microfluidics Research at Northwestern”, with W.K. Liu, Feb. 28, 2008.
115. California State University, Fullerton, “Introduction of Research at the Department of Mechanical Engineering at Northwestern University”, Feb. 27, 2008.
116. 2008 NSF Engineering Research and Innovation Conference in Knoxville, Tennessee, U.S.A. “An American Manufacturing Innovation Initiative”, Jan. 10, 2008.
117. 14th International Symposium on Plasticity and its Current Applications in Kailua-Kona, Hawaii, U.S.A, “Experimental and Numerical Investigation of Combined Isotropic-kinematic Hardening Behavior”, Jan. 4, 2008.
118. International Symposium on Automotive Sheet Metal Forming, India, Dec. 17, 2007, “Predictability of Numerical Simulations”.
119. Keynote, International Conference on Future Trends in Composite Materials and Processing, India, Dec. 14, 2007, “Material Characterization of Woven Composites”.
120. Keynote, International Conference on Intelligent Textiles, Seoul, South Korea, Nov. 12, 2007, “Material Characterization of Woven Composites”.
121. INSA-Lyon (Institut National des Sciences Appliquées de Lyon), France, Sept. 20, 2007, « Size Effects in Woven Composites and Metals ».
122. Ford Motor Company, Dearborn, Michigan, September 7, 2007, “Enhancing Interface Performance through Surface Texturing”.
123. Workshop on Advanced Technologies for New Materials, Taiwan, July 16, 2007, « Develop Computer-Integrated Systems for Composite Sheet Forming Processes From Micro to Macro Scale”.
124. SME Micromanufacturing Conference (short course), March 13, 2007, “Fundamentals and Challenges in Microforming”.
125. University of Stuttgart, Institute of Metal Forming, Germany, Oct. 5, 2006, “Mechanics and Control of Sheet Metal Forming Processes in Automotive Applications”.
126. General Motors, September 29, 2006, “An Investigation of Surface Distortion in Line Dies”.
127. University of Michigan, Ann Arbor, September 28, 2006, “Manufacturing at Multi-scales”.
128. Tokyo University of Agriculture and Technology, Japan, July 14, 2006, “Mechanics and Control of Sheet Metal Forming Processes”.
129. Nagoya Institute of Technology, Japan, July 7, 2006, “Fundamentals and Challenges in Microforming”.
130. Toyota, July 7, 2006, “Characterization of Wrinkling and Draw-in in Sheet Metal Forming”.
131. Chung Yuan Christian University, Taiwan, July 5, 2006, “Fundamentals and Challenges in Microforming”.
132. Shanghai JiaoTong University, China, June 28, 2006, “Advances in Metal Forming”.
133. Boeing Phantom Works, St Louis, Missouri, June 13, 2006, “Manufacturing at Multi-scales”.
134. General Motors, Michigan, April 3, 2006, “Prediction of Surface Distortion”.
135. Univ. of Massachusetts, Lowell, April 21, 2006, “Career Program Development”.
136. The Chinese University of Hong Kong, Hong Kong, January 18, 2006, “Manufacturing at Multi-scales”.
137. HuaZhong University of Science and Technology, China, January 16, 2006, “Mechanics and Control of Sheet Metal Forming Processes”.

138. Hong Kong University of Science and Technology, January 13 2006, “Material Characterization of Woven Composites”.
139. Purdue University, December 15, 2005, “Manufacturing at Multi-scales”.
140. M.I.T., November 29, 2005, “Manufacturing at Multi-scales”.
141. Unico, Inc., Wisconsin, November 22, 2005, “Real-time Calculation of Optimal Blank Holder Force History in Sheet Metal Forming”.
142. IMECE Panel on Biomanufacturing, November 10, 2005, “Micromanufacturing”.
143. General Motors, Michigan, October 27, 2005, “Characterization of Draw-in and Wrinkling in Sheet Metal Forming”.
144. Shanghai JiaoTong University, China, Oct. 11, 2005, “Innovative Processes for Sustainable Manufacturing”.
145. Plenary Talk: M&P 2005, Seattle, WA, June 21, 2005, “Manufacturing at Multi-scales”.
146. Drexel University, September 23, 2005, “Manufacturing at Multi-scales”.
147. Clemson University, August 30, 2005, “Mechanics and Control of Sheet Metal Forming Processes in Automotive Applications”.
148. Georgia Tech Institute of Technology, Oct. 29, 2004, “Microforming: Study of Grain Size and Friction Effects in the Extrusions of Micropins”.
149. Purdue University, Oct. 12, 2004, “Current Activities and Future Directions in Manufacturing Processes Research”.
150. Hong Kong University of Science and Technology, December 9, 2003, “Fundamentals of Forming at Multiple Scales”.
151. Ohio State University, November 13, 2003, “Understanding the Material Processing & Manufacturing Program”.
152. National Science Foundation, May 27, 2003, “Sheet Forming and Looking Beyond”.
153. New Jersey Institute of Technology, November 13, 2002, “Modeling Tools and Forming Technologies for the Enhancement of Design Attributes”.
154. Michigan Technological University, November 1, 2001, “Modeling Tools and Forming Technologies for the Enhancement of Design Attributes”.
155. University of Leuven, Belgium, April 23, 2001, “The Relationship between Materials Characterization Methods and Material Models for Stamping of Woven Fabric/Thermoplastic Composites”.
156. MSC, Inc., Illinois, December 17, 2000, “Analysis of the Softcoil Problem”.
157. Illinois Institute of Technology, November 29, 2000, “Material Characterization in Forming Structure Composites”.
158. Rensselaer Polytechnic Institute, September 22, 2000, “Material Characterization in Forming Structure Composites”.
159. General Electric, September 21, 2000, “Material Characterization in Forming Structure Composites”.
160. University of Nevada, Reno, September 14, 2000, “Material characterization and instability analysis in sheet materials forming”.
161. Ford Scientific Research Lab, September 6, 2000, “Material Characterization in Forming Structure Composites”.
162. National Steel Inc. , September 8, 2000, “Material Characterization and Instability Analysis in Sheet Materials Forming”.
163. Columbia University, July 6, 2000, “A Computer Integrated System for Sheet Forming”.

164. Northeastern University, May 12, 2000, “Modeling Tools and Forming Technologies for the Enhancement of Design Attributes”.
165. University of Illinois, Chicago, February 17, 2000, “A Computer Integrated System for Sheet Forming”.
166. General Motors, January 28, 2000, “Stamping Technologies to Reduce Weight and Lead Time”.
167. University of Washington, January 7, 2000, “A Computer Integrated System for Sheet Forming”.
168. Northwestern Polytechnical University, December, 1999, “Material Characterization in Forming Structure Composites”.
169. Georgia Institute of Technology, September 7, 1999, “A Computer Integrated System for Sheet Forming”.
170. University of Maryland, College Park, July 21, 1999, “A Computer Integrated System for Sheet Forming”.
171. Women in Engineering, University of Maryland, July 23, 1999.
172. Keynote, ‘Plasticity in Manufacturing Processes & Product Performance’ at 13th U. S. National Congress of Applied Mechanics, Gainesville, Florida, 21-26 June 1998.
173. University of Massachusetts, Lowell, September 15, 1998, “A Computer Integrated System for Sheet Forming”.

PROFESSIONAL ACTIVITIES

Committee Memberships

Member, Selection Committee of the Hong Kong Jockey Club Global STEM Post-doctoral Fellowship, October 1, 2023 – September 30, 2026.

Member, Workshop on "Additive Manufacturing: Projected Scientific Breakthroughs in 2027-2032", DEVCOM Army Research Laboratory Technology Forecasting Office, March 2023.

Chair, SME International Awards and Recognition Committee, Jan. 2023 – present

Member, Option of A National Plan for Smart Manufacturing: A Consensus Study, The National Academies of Science, Engineering and Medicine, August 2022 – February 2024.

Member, National Academies' National Materials and Manufacturing Board, February 24, 2022 – December 31, 2024.

Chair, ASME Technical Committee on Publications and Communications, January 1, 2022 – December 31, 2024.

Member, Planning Committee, Convergent Manufacturing [Platform] - A Future of Additive, Subtractive, and Transformative Manufacturing: A Workshop, The National Academies of Science, Engineering and Medicine, July 2021 – March 2022.

Member, Research Intelligence Working Group, NSF Engineering Research Vision Alliance, 2021 – present.

Member, SME Board of Directors, January 1, 2021 – December 31, 2025

Member, SME International Awards and Recognition Committee, Jan. 2021 – Dec. 2022

External Review Board, NSF Consortium for Louisiana Materials Design Alliance (LAMDA), July 2020 - June 2025.

Member, ASME Manufacturing Public Policy Task Force, ASME, June 2020 – present.

Chair, Ehmann Manufacturing Medal, ASME, January 2020 – December 2022.

Member, Review committee, Schmidt Science Fellows, U.K., 2019.

Member, International Expert Panel, Department of Mechanical Engineering, Technical University of Denmark, October 2019 – November 2019.

Member, ASME Technical Committee on Publications and Communications, January 1, 2019 – December 31, 2021.

Member, Engineering Panel of Research Grants Council of Hong Kong, November 2018 – Oct. 2024.

Member, Advisory Board, NSF Nanomanufacturing Node, University of Illinois at Urbana-Champaign, 2018 – present.

Vice-Chair, Additive Manufacturing Collaborative Working Group, The International Academy for Production Engineering (CIRP), January 2018 – December 2020.

Chair, STC-Forming, The International Academy for Production Engineering (CIRP), January 2017 – December 2019.

Member, Scientific Advisory Board, Digital Manufacturing and Design (DManD) Centre, Singapore University of Technology and Design, July 2016 – 2019.

Member, Board of Directors, mHub, Chicago, May 2016 – present.

- Product Impact Fund I – A $15M venture fund that invests in seed and early stage physical product and hardware companies with deployment from 2021 to 2023. As a

board member and a strong believer of potential impacts from physical product development and manufacturing, Cao participates in fund raising and in the selection committee. The first cohort will be selected in 2021.

- Cao co-organized and co-sponsored the Women in Manufacturing events (2019 and 2020) with prominent all-women keynote speakers and panelists from industry. More than 100 women participated each time and nearly 50% of participants were from underrepresented groups.

External Review Board, NSF Consortium for Innovation in Manufacturing and Materials, Louisiana, Oct. 2015 to September 2020.

Member, Technical Advisory Board, MxD (previously as Digital Manufacturing and Design Innovation Institute), 2014 - present.

Member, Advisory Committee, Department of Mechanical Engineering, University of California, Berkeley, 2014 – Present

External Academic Advisor, Department of Mechanical and Biomedical Engineering, City University of Hong Kong, 2014 – 2017.

Member, Scientific Committee, Surface Integrity (3rd CIRP CSI), Charlotte, NC, June 8-10, 2016.

Vice-Chair, STC-Forming, The International Academy for Production Engineering (CIRP), January 2014 – December 2016.

Member, Chicago Metro Metals Consortium (CMMC) Research and Innovation Subcommittee, 2014 - present

Member, SME International Director and Member Council Nominating Committee, 2013 - 2014

Panelist, World Technology Evaluation Study on System Engineering for Renewable Energy, December 2012 – October 2013

Panelist, World Technology Evaluation Study on Transforming Tools of Emerging and Converging Technologies for Societal Benefit (beyond Nano-Bio-Info-Cognitive Technologies, NBIC2) http://www.wtec.org/NBIC2/index.html, June 2012 – June 2013.

Chair, M. Eugene Merchant Medal Committee of ASME/SME, July 2012 – June 2015.

Chair, SME/NAMRI Honors Committee, June 2012 – June 2013.

President, SME/North America Manufacturing Research Institution, June 2011 – June 2012.

Secretary, STC-Forming, The International Academy for Production Engineering (CIRP), January 2011 – December 2013.

President-elect, SME/North America Manufacturing Research Institution, May 2010 – May 2011.

Member, Johnson & Johnson Consumer Companies, Inc. Medal Committee, July 2010 – June 2013.

Chair, Administration and Finance Committee, ASME Technical Communities, July 2009 – June 2012.

Vice Chair, Manufacturing Group, ASME, July 2009 – June 2010.

Member, M. Eugene Merchant Medal Committee of ASME/SME, July 2007 – June 2012.

Secretary, SME/North America Manufacturing Research Institution, May 2009 – May 2010.

Board Member, SME/North America Manufacturing Research Institution, May 2004 – May 2011.

Chair, Conference Planning Committee, ASME/MED & SME/NAMRI & JMSE, 2009 - 2011

Executive Committee, ASME Manufacturing Engineering Division, July 2004– June 2009.

Incoming Member	July 2004 – June 2005
Secretary	July 2005 – June 2006

Program Chair	July 2006 – June 2007
Vice Chair	July 2007 – June 2008
Chair	July 2008 – June 2009

Member, ASME Manufacturing Technology Group Operating Boards, July 2008 – June 2009.

Member, Scientific Committee, ESAFORM (European Scientific Association for material FORMing), April 2006 – present. (2006 was the first year that ESAFORM invited researchers outside of Europe to be on the Scientific Committee)

Member, Scientific Committee, International Conference on Technology of Plasticity, September 2008.

Member, Scientific Committee, NUMIFORM'07, June 2007.

Member, Organization Committee, 2nd International Conference on Micromanufacturing, Clemson, SC, 2007.

Member, Organization Committee, 1st International Conference on Micromanufacturing, Urbana, IL, 2006.

Member, Program Committee, International Conference on Frontiers of Design and Manufacturing, 2006.

Member, Scientific Committee, NAMRC, 2005 – present.

Member, Executive Committee, North American Deep Drawing Research Group, March 2003 – June 2006.

Member, Technical Committee, 8th International Conference on Numerical Methods of Industrial Forming Processes, NUMIFORM'2004, Columbus, Ohio.

Member, Technical Committee, NUMISHEET'2005, Detroit, Michigan.

Member, USA program committee, 2004 Japan-USA Symposium on Flexible Automation, Denver, U.S.A.

Chair, Program Committee of ASME Manufacturing Engineering Division, May 2001 – Nov. 2002

Chair, Committee on Integration of Computational Mechanics and Manufacturing (ICMM), US Association for Computational Mechanics, December 1999 – 2000

Chair, Committee on Materials Processing and Manufacturing, Applied Mechanics Division, ASME, Nov. 2001 – Nov. 2003.

Member, USA program committee, 2002 Japan-USA Symposium on Flexible Automation, Hiroshima, Japan.

Member, International executive committee, the 10th JSME/ASME Materials and Processing Conference, U.S.A., Oct. 15-18, 2002.

Vice-Chair, Committee on Materials Processing and Manufacturing, Applied Mechanics Division, ASME, Nov. 1999 – Nov. 2001.

Scientific Committee Member, WSES International Conference on Mathematics and Computers in Mechanical Engineering, Marathon, Florida Keys, Florida, July 25-29, 1999

Liaison Officer, Manufacturing Engineering Division of ASME, Nov. 1998 – May 2001.

Organizers

Organizer, 2023 World Congress on Micro and Nano Manufacturing, Sept. 18 – 21, 2023, Evanston, Illinois.

Organizer, 2020 International Symposium on Flexible Automation, Chicago, Illinois.

Organizer, 2020 CIRP Conference on Manufacturing Systems, Chicago, Illinois.

Organizer, 3rd CIRP Biomanufacturing Conference, July 11-14, 2017, Chicago, Illinois.

Organizer, North America Deep Drawing Research Group Annual Meeting, May 5, 2015, Evanston, Illinois.

Organizer, Workshop on Future Research Needs in Advanced Manufacturing from Industrial Perspective, sponsored by NSF, August 11-13, 2013, Arlington, Virginia.

Program co-Chair, 1st CIRP BioManufacturing Conference, March 2013, Tokyo, Japan.

Conference co-Chair, 2012 International Conference on MicroManufacturing, March 2012, Evanston, IL.

Program co-Chair, 2010 ASME/JSME International Flexible Automation, Tokyo, Japan, 2009 – 2010.

Program co-Chair, ASME Nanoengineering for Medicine and Biology, Feb. 2010.

Conference Chair, ASME International Conference of Manufacturing Science and Engineering & JSME Materials & Processing, Evanston, IL, Oct. 2008.

Conference co-Chair, 6th International Workshop on Microfactories, Evanston, IL, Oct. 2008.

Co-organizer, Mini-symposium on Composites, ESAFORM 2008, Lyon, France, April 2008.

Organizer, Panel on Coping with the CAREER Award, National Science Foundation DMII Grantee Conference, TN, January 2008.

Co-organizer, CAREER Proposal Writing Workshop, sponsored by NSF, March 23-26, 2007.

Co-organizer, Workshop on Advanced High-Strength Steels, co-sponsored by NSF, DoE and ASP, October 22-23, 2006.

Co-organizer, Mini-symposium on Composites, ESAFORM 2007, Spain, April 2007.

Co-organizer, CAREER Proposal Writing Workshop, sponsored by National Science Foundation, April 6, 2006.

Co-organizer, Mini-symposium on Composites, ESAFORM 2006, April 2006.

Co-organizer, CAREER Proposal Writing Workshop, sponsored by National Science Foundation, May 24, 2005.

Co-organizer, Mini-symposium on Composites, ESAFORM 2005, April 2005.

Co-organizer, CAREER Proposal Writing Workshop, sponsored by National Science Foundation, Nov. 13, 2004.

Organizer, Symposium on Computational Methods in Sheet Forming, *Sixth World Congress on Computational Mechanics*, Beijing, China, September 5-10, 2004

Chair, Benchmark Analysis Summary Committee, *NUMISHEET2005*, Detroit, September, 2005.

Organizer, Benchmark Analysis on Composite Sheet Forming, 2002 – present.

Organizer, Symposium on Materials Development and Utilization in Forming, *International Mechanical Engineering Congress and Exposition*, New York, New York, November, 2001.

Organizer, National Science Foundation Workshop on Composite Sheet Forming, Lowell, Massachusetts, September, 2001.

Organizer, CAREER Workshop at *the 2001 National Science Foundation Design and Manufacturing Research Conference*, Tampa, Florida, January, 2001.

Organizer, Symposium on Advances in Metal Forming, *International Mechanical Engineering Congress and Exposition*, Orlando, Florida, November, 2000

Co-Organizer, Session "Affordable Composites Manufacturing: New Advances in Forming, Stamping, and other rapid processing methods", at the *15th Annual Technical Conference of the American Society for Composites (ASC),* Texas, September, 2000.

Organizer, CAREER Workshop at *the 2000 National Science Foundation Design and Manufacturing Research Conference*, Vancouver, British Columbia, Canada, January, 2000.

Co-Organizer, Session 'Engineering Mechanics in Manufacturing Processes and Material Processing', ASME summer conference, McNu'97, Evanston, Illinois, July 1997.

NU Service

Chair, Office for Research Advisory Council, 2021 – present.

ORAC is designed to increase engagement between the Office for Research (OR) and University faculty. ORAC provides OR with important perspectives that help inform research practices and policies. The Council also serves as a forum for OR leadership to collaborate with key faculty stakeholders and communicate strategic objectives.

Member, AI@Northwestern Committee, 2020 – present.

Member, Faculty Hiring Search Committee, Materials Science and Engineering, 2019 – 2020.

Member, Advisory Board for the Office of Fellowships, September 2019 – present

Member, IIN Ryan Fellowship Review Committee, 2018 – present

Chair, Faculty Hiring Search Committee, Mechanical Engineering, 2017 – 2018.

Member, Faculty Hiring Search Committee, Physics and Astronomy, 2016.

Member, Program Review of School of Education and Social Policy, 2016.

Member, Faculty Hiring Search Committee, Mechanical Engineering, 2016.

Member, Search Committee for Senior Vice President for Business and Finance, Feb. – June 2014.

Associate Vice President for Research, October 2012 – August 2021

Cao represented Office for Research (OR), particularly in the physical sciences and engineering domain, to external partners in building up funded research activities. She also provided advises to VPR on the strategic direction and operation of OR, served as the bridge between OR, associate deans, faculty directors of university research centers, and core facilities in physical sciences and engineering. Cao oversaw the strategic direction, new initiatives and long term sustainability of the University's core facilities. Several university research centers reported to her, including the Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA), the Materials Research Center (MRC), the Northwestern University Atomic and Nanoscale Characterization Experimental Center (NUANCE), and Center for Applied Physics & Superconducting Technologies (CAPST). Professor Cao fostered collaboration between the physical sciences and engineering and the other disciplines across and beyond Northwestern, at the national and international stages. Her major initiatives and accomplishments are summarized below.

Research Loan for Old or Duplicative Equipment (ReLODE) Program (2014 – present)

- Initiated the idea in the summer of 2014, approved by VP for Research, Provost and the budget office, and implemented in 2015.
- The objective is to establish a sustainable loan program that will enable core facilities to make necessary purchases/repairs of essential, highly used, aging equipment without interrupting the continuity of research activities.
- The new loan program fills the gap between what external federal funding opportunities will likely to fund (state-of-the-art equipment) and the current internal equipment grant program (small items).
- After the 5-years operation, ReLODE has reached the sustainability goal and has been shared in the nation's core facilities' organizations.

Member, Advisory Council for the Office of Fellowships, September 2013 – 2018

Member, Tenure and Promotion Committee, McCormick, Northwestern University, Sept. 2011 – August 2013.

Member, The Limited Submissions Advisory Committee, Northwestern University, Sept. 2009 – August 2010.

Member, Faculty Search Committee, Sept. 2009 – Feb. 2010.

Chair, ME Graduate Studies, Mechanical Engineering, Sept. 2007 – Sept. 2012

- secured an external donation for encouraging women to pursue graduate studies in micro- and nano-technologies.

Member, General Faculty Committee, Northwestern University, Sept. 2008 – August 2011

Member, ME Machine Shop Oversight Committee, Sept. 2008 – August 2009

Member, Faculty Search Committee, Mechanical Engineering, Oct. 2007 – May 2008

Interim Associate Chair, Mechanical Engineering, Sept. 2006 – August 2007

Speaker, NSF Graduate Fellowships Meeting, Oct. 2, 2007

Speaker, Navigating the Professoriate Program: Grantsmanship and Identifying Funding Opportunities, April 5, 2007.

Member, Energy Committee, Mechanical Engineering, Jan. 2006 – June 2006.

Organizer, Mechanics Colloquia Seminar Series, 2001 – Sept. 2003.

Editor, Newsletter of Department of Mechanical Engineering, 1998 – Sept. 2003

Member, Faculty Search Committee, Industrial Engineering, Oct. 2002 – June 2003.

Member, Faculty Search Committee, Mechanical Engineering, Sept. 2001 – Sept. 2002

Member, Committee on Classrooms of the Searle Center for Teaching Excellence, January - June, 2000.

Member, Faculty Search Committee, Mechanical Engineering, August 1999 – January 2000.

Creator, ME Design and Manufacturing Group Web Site, 1998.

Member, College Curriculum Committee, Northwestern University, Fall 1997.

National Science Foundation (NSF) Service

Panelist, the World Technology Evaluation Study on Advanced Manufacturing, www.wtec.org/advmfg, sponsored by NSF.

Initiated the World Technology Evaluation Study on Micro-manufacturing, www.wtec.org/micromfg, Dec. 2003 – September 2005, co-sponsored by NSF, ONR, DOE and NIST.

Co-initiated joint proposal review and co-funding for proposals in the area of predictive polymer processing between NSF/DMII and DOE, 2005.

Co-initiated joint proposal review and co-funding for proposals in the area of coating and deposition between NSF/DMII and NSF/CMS, 2004 – 2005.

Co-initiated joint proposal review and co-funding for proposals in the area of thermo-related processes between NSF/DMII and NSF/CTS, 2004.

Co-sponsored the CAREER proposal writing workshop, November 2004

Co-sponsored the CAREER proposal writing workshop, May 2005.

Co-sponsored the Predictive Modeling workshop, July 2005.

Initiated and sponsored the Biomanufacturing workshop, June 2005.

Member, Engineering workgroup on Cyberinfrastructure, 2005

Other Activities

Mentor, Future Leaders in Mechanical and Aerospace Engineering: Celebrating Diversity and Innovation, 2021 – present.

Member, Advisory Board, New Trier High School Engineering Partnership, 2012 – 2020.

Member, MIT Educational Council, 2012 – 2019.

Judge, Student Oral Presentation and Posters, HBCU-UP conference, Washington, D.C., October 2007.

Professeur invité, L'Institut National Des Sciences Appliquees de Lyon, France, June – Sept. 2007.

Member, Strategic Planning Committee, School District 37, Illinois, 2003.

Activity officer of the Mechanical Engineering Women Graduate Association, MIT, 1994-1995.

Selected participant for the NSF New Century Scholars Workshop, Stanford University, August 2-7, 1998.

COURSES LECTURED

Graduate Courses:

ME-415:	Mechanics of Manufacturing Processes (developed)
ME-445:	Micromanufacturing (co-developed)
ME-441:	Optimization in Manufacturing Processes
ME-442:	Advanced Metal Forming

Undergraduate Courses:

ME-240:	Introduction to Mechanical Design & Manufacturing
ME-340-1:	Introduction to Manufacturing Processes

ME-340-2: CAD/CAM

STUDENTS GRADUATED

Ph.D. Students:

1. Hong Yao, Mechanical Engineering, June 2000, *Process Design and Failure Analysis of Three Dimensional Sheet Metal Forming Using Simplified Numerical and Analytical Models*, currently Sr. Research Engineer, ArcelorMittal, U.S.
2. Xi Wang, Mechanical Engineering, December 2000, *Stress-based Wrinkling Criteria and Experimental Verification in Sheet Metal Forming*, currently Senior Software Engineer, Nicksun, Inc.
3. Brad L. Kinsey, Mechanical Engineering, June 2001, *A Combined Approach to Improve and Assess the Formability of Tailor Welded Blanks,* currently Professor and Center Director, University of New Hampshire, Durham. NSF CAREER award recipient.
4. Xiongqi Peng, Mechanical Engineering, December 2003, *Material Characterization and Stamping Simulation for Woven Composites,* currently Professor, Shanghai JiaoTong University, China.
5. Thaweepat Buranathiti (now Purit Thanakijkasem), Mechanical Engineering, June 2005, *Design and Optimization under Uncertainty in Sheet Metal Forming Processes Constrained with Failure Analysis*, currently Associate Professor and Chair, King Mongkut's University of Technology, Thonburi.
6. Neil Krishnan, Mechanical Engineering, June 2006, *Microforming: Experimental Investigation of Size Effects in the Extrusion of Micropins*, currently Manager, Advanced Manufacturing Engineering, Sandvik Hyperion.
7. Shawn H. Cheng, Mechanical Engineering, December 2009, Experimental and Numerical Analysis of Material Deformation Behavior in Sheet Metals and Its Forming Process, currently CEO, HUPU.com, named one of the Nine Promising Young Entrepreneurs in China by Forbes.
8. Numpon Mahayotsanun, Mechanical Engineering, December 2010, Study of Size and Strain Rate Effects in the Micro-Extrusion Process, currently at King Mongkut's University of Technology.
9. Tiffany Davis Ling, Mechanical Engineering, December 2011, Mechanics and Control of Laser Surface Texturing and its Applications in Energy Efficiency and Production, was a Lead Senior Process Engineer at Honeywell Aerospace, currently as Lead Design Faculty in Instruction, at University of St. Thomas.
10. Rui Zhou, Mechanical Engineering, December 2011, Process Mechanics and Design of Deformation-based Surface Texturing System, currently Senior Engineer at Apple Inc., received 2020 SME Outstanding Young Manufacturing Engineers Award.
11. Rajiv Malhotra, Mechanical Engineering, June 2012, Formability and Toolpath Planning in Incremental Forming, currently at Rutgers as a tenure-track Assistant Professor, received 2017 SME Outstanding Young Manufacturing Engineers Award.
12. James Magargee, Mechanical Engineering, June 2014, Mechanics of Electrically-Assisted Deformation in Metals, was at 3M, now at Apple.
13. Ishan Saxena, Mechanical Engineering, December 2015, Laser Induced Plasma Micro-Patterning, currently at Intel.

14. Jacob Smith, Mechanical Engineering, February 2016, Computational Approaches for Analyzing Flexible Manufacturing Processes and Advanced Materials: Towards Understanding the Inherent Multiscale Multiphysical Phenomena, currently at Apple, received 2023 SME Outstanding Young Manufacturing Engineers Award.
15. Xiaoli Wang, Mechanical Engineering, February 2016, Mechanics of Magnetostrictive Thin Film Deformation and Its Application in Active X-Ray Optics, currently as a faculty Zhejiang Institute of Technology.
16. Man Kwan Ng, Mechanical Engineering, December 2017, Fundamentals and Applications of Electrically-assisted Microrolling, currently as an Engineering Physicist at Fermi National Laboratory.
17. Ebot Etchu Ndip-Agbor, Mechanical Engineering, June 2018, Rapid Analysis and Planning Tools for Flexible Manufacturing Processes in a Cyber-Physical Setting, was at Autodesk, currently at Apple, received 2024 SME Outstanding Young Manufacturing Engineers Award.
18. Zixuan Zhang, Mechanical Engineering, June 2018, Hybrid Incremental Sheet Forming Methods for Enhanced Process Performance and Material Properties, at Microsoft, received 2023 SME Outstanding Young Manufacturing Engineers Award.
19. Huaqing Ren, Mechanical Engineering, August 2018, Modeling and Control of the Double-Sided Incremental Forming Process, at Apple Inc.
20. Sarah Wolff, Mechanical Engineering, December 2018, Laser-matter interactions in directed energy deposition, was at Argonne National Lab as an Enrico-Fermi Postdoctoral Fellow, at the Ohio State University as an assistant professor, received 2022 SME Outstanding Young Manufacturing Engineers Award.
21. Daniel J. Garcia, Chemical Engineering, June 2019, Life Cycle Optimization of Sustainable Water-Energy-Food Nexus Systems and Networks, at Exxon.
22. Weizhao Zhang, Mechanical Engineering, August 2019, Fundamentals of Thermoforming Processes of Carbon Fiber Reinforced Plastic (CFRP) Parts, at The Chinese University of Hong Kong as an assistant professor.
23. Newell Moser, Mechanical Engineering, December 2019, Deformation Mechanisms and Process Planning in Double-Sided Incremental Forming, at NIST.
24. Yi Shi, Mechanical Engineering, December 2019, Curved Water Jet Guided Laser Micro-Manufacturing, at Intel.
25. Marco Giovannini, Mechanical Engineering, January 2020, Soft Tissue Cutting in Core Biopsy.
26. Puikei Cheng, Mechanical Engineering, June 2020, Additive Manufacturing Toolpath Design using Graph Theory, at Exponent (formerly Failure Analysis Associates) consulting firm.
27. David Pritchet, Mechanical Engineering, June 2020, Electrophoretically Guided Micro Additive Manufacturing Process, at Intel.
28. Nicolas Martinez Prieto, Mechanical Engineering, June 2020, Electrohydrodynamically-Driven Micro-Additive Manufacturing Processes: Characterization and Control, at Intel.
29. Jennifer Bennett, Mechanical Engineering, June 2021, Tailored Mechanical and Geometric Properties in Directed Energy Deposition via Global Thermal Control, at United States Military Academy West Point as an Assistant Professor, received 2022 SME 30 under 30 Award.

30. Mojtaba Mozaffar, Mechanical Engineering, July 2021, Physics-Informed Data-Driven Prediction and Design in Advanced Manufacturing Processes, at Northwestern University as a Research Assistant Professor and then at Amazon.
31. Zilin Jiang, Mechanical Engineering, June 2022, Process Understanding of Hybrid Multi-step Incremental Sheet Forming, at Apple.
32. Jiaxi Xie, Mechanical Engineering, June 2022, A Generic Finite Element Solver by Meta-expressions, at MathWorks.
33. Samantha Ann Webster, Theoretical and Applied Mechanics, August 2022, Establishing Process-Structure Relationships in Laser Powder Blown Directed Energy Deposition Through In-situ Investigation, at NIST, received 2022 SME 30 under 30 Award.
34. Dohyun Leem, Mechanical Engineering, July 2022, Forming Strategy Design and Mechanics Analysis in Flexible Sheet Metal Forming Systems, at General Motors.
35. Shuheng Liao, Mechanical Engineering, May 2023, Toward a Digital Twin of Metal Additive Manufacturing: Process Optimization and Control Enabled by Physics-based and Data-driven Models, at M.I.T. as a post-doctoral fellow.
36. Suman Bhandari, Mechanical Engineering, 2023, Laser-Induced Plasma Micro-Machining Process Enhancement.

M.S. Students:

1. Brad L. Kinsey, Mechanical Engineering, June 1998, *Process Control in Sheet Metal Forming,* currently Associate Professor, University of New Hampshire, Durham.
2. Nan Song, Mechanical Engineering, December 2000, *Springback Prediction of Straight Flanging Operation,* currently R&D Software Developer, Bloomberg, L.P.
3. Vikram Viswanathan, Mechanical Engineering, December 2000, *Experimental Investigation of Forming Limit Curve for Tailor Welded Blanks and Physical Implementation of Neural Network for Springback Control,* currently at Adobe.
4. Neil Krishnan, Mechanical Engineering, December 2003, *Estimation of optimal blank holder force trajectories in segmented binders using an ARMA model*, currently Manager, Advanced Manufacturing Engineering, Sandvik Hyperion.
5. Shawn Cheng, Mechanical Engineering, June 2004, *Experimental study on wrinkling characterization and an accelerated method for springback compensation*, continued as a Ph.D. student at Northwestern.
6. Numpon Mahayotsanun, Mechanical Engineering, June 2005, Draw-in sensor for sheet metal forming, continued as a Ph.D. student at Northwestern.
7. Anthony Swanson, Mechanical Engineering, June 2006, Experimental analysis of die wear in deep drawing with nanometer precision, a consultant in Chicago.
8. Michael Beltran, Mechanical Engineering, December 2010, Investigation of the Incremental Forming Process at a Micro-Scale, a lab manager/lecture at Northwestern University, co-founder of Scimplicity LLC.
9. Tim Rockers, Mechanical Engineering, August 2012, Tension and compression test of a sheet metal.
10. Tim Velasquez, Mechanical Engineering, January 2013, Feasibility of Laser Surface Texturing for Friction Reduction in Surgical Blades.
11. Sifang Zhou, Mechanical Engineering, June 2013, Bulk Metallic Glasses for Micro-Rolling, at Mori Seiki.

12. Rui Xu, Mechanical Engineering, June 2014, Process Accuracy Improvement and Performance Study of Incremental Forming, continuing his Ph.D. study at Stanford.
13. Jiachen (Jackson) Xu, Mechanical Engineering, June 2014, currently at Apple, A Novel Method of Evaluating the Tensile and Compressive Behavior of Thin Metal Sheet Using a Transparent Device.
14. Yuanqiao Wu, Mechanical Engineering, Spring 2015.
15. Jintao Liu, Mechanical Engineering, June 2015, Laser Surface Processing: Laser Shock Peening and Biprism interference micromachining.
16. Satyabrata Mohanty, Mechanical Engineering, June 2015, Electrical Micro Manipulation of Jet Trajectory for Water Jet Based Micro-manufacturing.
17. Lingxuan Su, Mechanical Engineering, Fall 2015.
18. Tanvy Limaye, Mechanical Engineering, Fall 2015.
19. Gabriela Fratta, Mechanical Engineering, Spring 2016.
20. Ebot Etchu Ndip-Agbor, Mechanical Engineering, Summer 2016.
21. Sixuan Chen, Mechanical Engineering, Summer 2018.
22. Haiguang Liao, Mechanical Engineering, Summer 2018.
23. Wenjia Wang, Mechanical Engineering, Fall 2018
24. Qiyan Chen, Mechanical Engineering, Fall 2020
25. Indrajeet Gupta, Mechanical Engineering, Fall 2021
26. Sangram Rout, Mechanical Engineering, Fall 2021
27. Arpan Patel, Mechanical Engineering, Spring 2022
28. Songlin Duan, Mechanical Engineering, Spring 2023

CURRENT RESEARCH PERSONNEL

Post-doctoral Fellow:

Dr. Jihoon Jeong	(2021 – 2023)
Dr. Fan Chen	(2023 – 2024)

Ph.D. Students:

Miss Marisa R. Bisram	(expected 2024)
Miss Sanjana Subramaniam	(expected 2024)
Mr. Derick Suarez	(expected 2024)
Mr. Conor Porter	(expected 2024)
Mr. Fred Carter	(expected 2025)
Mr. Putong Kang	(expected 2025)
Mr. Vasudev Aravind	(expected 2025)
Mr. Jin Choi	(expected 2025)
Miss Itzel Salgado	(expected 2026)
Mr. Rujing Zha	(expected 2026)
Mr. Daniel Quispe	(expected 2026)
Miss Faith Rolark	(expected 2027)
Miss Nhung Nguyen	(expected 2027)
Mr. Fanglei Hu	(expected 2027)
Mr. Brett B. Wadman	(expected 2028)
Mr. Garrett Mathesen	(expected 2028)

Undergraduate Students:

Mr. Dean Huang	(expected 2023)

Mr. Anchen Tong	(expected 2023)
Ms. Gracia Cosenza	(expected 2023)
Mr. Brandon Beckle	(expected 2023)
Ms. Raymonde Council	(expected 2023)
Mr. Julian Rocher	(expected 2024)
Ms. Penelope de la Torre	(expected 2024)
Mr. Henry Victor-Halliday	(expected 2024)
Ms. Molly Adams	(expected 2025)

RESEARCH PERSONNEL SUPERVISED

Post-doctoral Fellows:

Dr. Dominik Kozjek	(2021 – 2023)
Dr. Tianju Xue	(2022 – 2023)
Dr. Ashkan Golgoon	(2020 – 2021)
Dr. Qiang Zeng	(2013 – 2018)
Dr. Biao Liang	(2016 – 2018)
Dr. Xiaoli Wang	(2016 – 2017)
Dr. Taekyung (Terry) Lee	(2015 – 2015)
Dr. Rajiv Malhotra	(2012 – 2013)
Dr. Ying Huang	(2006 – 2009)
Dr. Wonoh Lee	(2006 – 2008)
Dr. Shunping Li	(2000 – 2005)
Dr. Kum Cheol Shin	(2003 – 2004)
Dr. Hongsheng Lu	(2002 – 2004)
Dr. Xue (Patricia) Pu	(2000 – 2002)
Dr. Zhihong Liu	(1998 – 1999)
Dr. Choong Ho Lee	(1998 – 1999)

Visiting Scholars:

Dr. Xifeng Li	(2011 – 2012)
Prof. Yun Wang	(2008)
Prof. Xudong Kang	(2008)
Prof. Zhong Wang	(2003 – 2004)
Dr. Riccardo Ruffini	(1997)
Mr. Steffen Hägebarth	(2004)
Mr. Anupam Agrawal	(2006)
Prof. Venkat Reddy	(2006 – 2007)
Prof. Yongjun Wang	(2007 – 2008)
Mr. Ning Ma	(2009 – 2010)
Prof. Chun Xu	(2010 – 2011)
Mr. Weichao Wu	(2009 – 2011)
Mr. Deniz Akturk	(2012 – 2012)
Mr. Dongkai Xu	(2010 – 2012)
Ms. Fan Rong	(2010 – 2013)
Prof. Xie Le	(2014)
Ms. Lanyun Li	(2014 – 2015)
Mr. Youqiang Xing	(2015 – 2016)
Mr. Wei Wang	(2014 – 2015)
Mr. Xinwei Wang	(2014 – 2015)
Ms. Beatrice Valoppi	(2015)
Mr. Antonio Jose Sanchez Egea	(2015 – 2016)

Miss Huan Zhang (2014 – 2016)
Mr. Wule Zhu (2015 – 2016)
Mr. Adrian Lindenmeyer (2019)
Mr. Eiichi Ota (2019 – 2020)

Undergraduate Students:

Miss Mikenzie Steffens (graduated 1999)
Mr. Joseph Goode (graduated 2000)
Mr. Francis Joe Mills (graduated 2001)
Mr. Alexander J. Ellis (graduated 2002)
Mr. Peter J. Leonard (graduated 2002)
Mr. Sasawat Mahabunphachai (graduated 2002)
Mr. Ibrahim Khalid Sahouh (graduated 2008)
Miss Kristi Bond (graduated 2008)
Miss Julia Padvoiskis (graduated 2008)
Mr. Phillip Ahn (graduated 2008)
Mr. Ben Schriesheim (graduated 2008)
Mr. Drew Price (graduated 2009)
Miss Rachel Cohen (graduated 2010)
Mr. KrystianZimowski (graduated 2010)
Miss Regan Radcliffe (graduated 2011)
Mr. Kevin Yngve (graduated 2011)
Mr. Stephen Guerin (graduated 2011)
Mr. Jeffrey Shih (graduated 2011)
Miss Morgan McHugh (graduated 2011)
Mr. Andrew Nelson (graduated 2011)
Miss Brooke Stanislawski (graduated 2012)
Miss Eliza Bifano (graduated 2012)
Mr. Justin Panhans (graduated 2012)
Miss Sarah Wolff (graduated 2013)
Mr. Max Abecassis (graduated 2014)
Mr. Olatunde Olufisayo Okeowo (graduated 2015)
Mr. Carter Robinson (graduated 2018)
Mr. Daniel Tian (graduated 2018)
Mr. Brandon Bay (graduated 2018)
Miss Zoe Granato (graduated 2019)
Mr. Phillip Kwon (graduated 2019)
Ms. Andrea Cardona (graduated 2019)
Mr. Logan Johnson (graduated 2021)

AWARDS STUDENTS RECEIVED

Presidential Fellowship is the most prestigious fellowship that Northwestern offers to graduate students. Typically, no more than eight Ph.D. students across the university receive this honor each year.

Terminal Year Fellowship is the most prestigious fellowship that McCormick School of Engineering offers to Ph.D. students in their final year.

Ryan Fellowship awards are for the best graduate students working in the exploration of fundamental nanoscale science and turning this knowledge into practical applications for the benefit of society.

Martin Fellowship awards are made to no more than three mid-career Ph.D. students in the Department of Mechanical Engineering.

NSF Fellowship refers to the NSF Graduate Research Fellowship.

GEM Fellowship refers to the National GEM Consortium Fellowship for underrepresented groups (African Americans, American Indians, and Hispanic Americans) in engineering and science.

Belytschko Outstanding Research Award is awarded for the best Ph.D. thesis in the Department of Mechanical Engineering, Northwestern University.

1. Brad L. Kinsey, ASME Student Design Manufacturing Competition, 3rd Place, 1998
2. Xi Wang, Terminal Year Cabell Fellowship, Northwestern University, 2000.
3. Xiongqi Peng, Terminal Year Cabell Fellowship, Northwestern University, 2003.
4. Numpon Mahayotsanun, NADDRG Student Presentation Award, 2007
5. Tiffany Davis, NU Research Implementation Award, 2007
6. Tiffany Davis, NSF Fellowship, 2007
7. Michael Beltran, NSF Fellowship Honorable Mention, 2008
8. Ibrahim Khalid Sahouh, Undergraduate Research and Innovation Award, Mechanical Engineering, Northwestern University, 2008
9. Huang, Y., Cao, J., Smith, S., Woody, B., Ziegert, J., and Li, M., Finalist, Best Paper Award, "Studies of Size Effect on the Formability of a Domed Part in Incremental Forming", MSEC-72545, Proceedings of the 2008 International Manufacturing Science and Engineering Conference, MSEC2008, October 7-10, 2008, Evanston, Illinois, USA.
10. Rui Zhou and Ibrahim K. Sahouh, 3rd place, 2008 ASME Student Manufacturing Design Competition, MSEC 2008, October 7-10, 2008, Evanston, Illinois, USA.
11. Rajiv Malhotra, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2009.
12. Tiffany Davis, Presidential Fellowship, Northwestern University, 2010.
13. Krystian Zimowski, Undergraduate Research and Innovation Award, Mechanical Engineering, Northwestern University, 2010
14. Rui Zhou, ISEN (The Initiative for Sustainability and Energy at Northwestern) Fellowship, Northwestern University, 2010.
15. Rui Zhou, Cabell Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2010
16. James Magargee, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2010 - 2011.
17. James Magargee and Morgan McHugh, 3rd place, 2010 ASME Student Manufacturing Design Competition, MSEC 2010, October, 2010, Erie, PA, USA.
18. Rajiv Malhotra, 2012 Best Poster Award, North America Deep Drawing Research Group, May, 2012, Oakland, MI.
19. Luke Francis Hemenetz and Tim Rockers, 2rd place, 2012 ASME Student Manufacturing Design Competition, MSEC 2012, June 2012, Notre Dame, USA.
20. James Magargee, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2010 – 2011.
21. Jacob L. Smith, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2012 - 2013.
22. Trista (Man Kwan) Ng, Honorable Mention, Martin Fellowship, Northwestern University, 2013.

23. Trista (Man Kwan) Ng, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2013 - 2014.
24. Jacob L. Smith, National Defense Science and Engineering Fellowship, US Department of Defense, 2013 – 2016.
25. James Magargee, ME Department Graduate Leadership and Service Award, 2013.
26. Nicolas Martinez Prieto, Ryan Fellowship, Northwestern University, 2014.
27. Newell Moser, National Science Foundation Graduate Fellowship, 2014 – 2017.
28. Jacob L. Smith, Martin Fellowship, Mechanical Engineering, Northwestern, 2014.
29. Zixuan Zhang, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2014-2015.
30. Zixuan Zhang, DOE ORISE Fellowship, 2016 – 2018.
31. Ebot Etchu Ndip-Agbor, DOE ORISE Fellowship, 2016 – 2018.
32. Huaqin Ren, DOE ORISE Fellowship, 2016 – 2018.
33. Sarah Wolff, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2014-2015.
34. Xiaoli Wang, Cabell Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2015.
35. Ebot Etchu Ndip-Agbor, Martin Fellowship, Mechanical Engineering, Northwestern University, 2015.
36. Jennifer Bennett, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2014-2015.
37. Marco Giovannini, Ryan Fellowship, Northwestern University, 2015
38. Sarah Wolff, SME North America Manufacturing Research Conference Student Best Presentation Award, 2nd round-up, 2016
39. Newell Moser, Martin Fellowship, Mechanical Engineering, Northwestern University, 2016.
40. Mojtaba Mozaffar, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2016.
41. Weizhao Zhang, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2016.
42. Daniel Garcia, Presidential Fellowship, Northwestern University, 2017.
43. Newell Moser, Royal E. Cabell Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2017.
44. Ebot Etchu Ndip-Agbor, Honorary Terminal Year Fellow, McCormick School of Engineering and Applied Science, Northwestern University, 2017.
45. Sarah Wolff, Enrico Fermi Fellowship, Argonne National Laboratory, a highly competitive fellowship awarded to postdoctoral scientists and engineers "who are at early points in promising careers, display superb ability in scientific or engineering research, and show definite promise of becoming outstanding leaders in their fields".
46. Jennifer Bennett, Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2018.
47. Marco Giovannini, Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2018.
48. Nicolas Martinez Prieto, Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2018.

49. Dohyun Leem, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2018.
50. Jennifer Bennett, ARL ORAU Fellowship, 2018 - 2019.
51. Samantha Ann Webster, NSF Graduate Research Fellowship, 2019.
52. Sanjana Subramaniam, NSF Graduate Research Fellowship, 2019.
53. Yi Shi, Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2019.
54. Mojtaba Mozaffar, Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2019.
55. Derick Suarez, GEM Fellowship, 2020.
56. Marisa Bisram, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2019.
57. Shuheng Liao, Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University, 2019.
58. Marisa Bisram, NSF Graduate Research Fellowship, 2020.
59. Marisa Bisram, Leadership and Service Award, Mechanical Engineering, Northwestern University, 2020.
60. Sanjana Subramaniam, Leadership and Service Award, Mechanical Engineering, 2021.
61. Samantha Ann Webster, Terminal Year Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2021.
62. Daniel Quispe, Cabell Fellowship, McCormick School of Engineering and Applied Science, Northwestern University, 2021.
63. Itzel Salgado, GEM Fellowship, 2021.
64. Samantha Ann Webster, Khoshnevis Student Awardee, Solid Freeform Fabrication Symposium, 2022.
65. Samantha Ann Webster, SME 30 under 30, SME, 2022.
66. Jennifer Bennett, SME 30 under 30, SME, 2022.
67. Rujing Zha, NSF Graduate Research Fellowship, 2023.
68. Shuheng Liao, Belytschko Outstanding Research Award, Department of Mechanical Engineering, Northwestern University, 2023.
69. Dean Huang, Undergraduate Research & Innovation Award, Department of Mechanical Engineering, Northwestern University, 2023.

SPONSORED PROJECTS

A total of over $52 million research grant funding has been received by Cao and her collaborators at Northwestern since 1996, among which Cao's funding totals nearly $23 million.

No.	Project title	Sponsor	Role	Period
105***	FMSG: Cyber: Learning Foundation Models for Manufacturing Design Automation	NSF	co-PI	1/24 – 12/25
104	Reinforcement of Double-sided Incrementally Formed Sheet Panel via Directed Energy Deposition	Nissan	PI	10/23 – 3/24

103	Control for Adaptive Additive Manufacturing Process	HiDeNN-AI	PI	6/23 – 6/24
102	Equipment: MRI: Track 1 Acquisition of a State-of-the-Art Plasma Focused Ion Beam-Scanning Electron Microscope (PFIB-SEM)	NSF	Co-PI	9/23 – 8/26
101	Concurrent Design of a Multimaterial Niobium Alloy System for Next-generation Turbine Applications	QuesTek LLC	PI	3/23 – 9/24
100	Machine learning powered simulation of additive manufacturing for real-time design and process optimization (subaward from ExLattice)	NSF	PI	8/22 – 1/24
99**	NSF Engineering Research Center for Hybrid Autonomous Manufacturing, from Evolution to Revolution (HAMMER)	NSF	NU PI***	9/22 – 8/27
98*	Multiscale Ironing Model Development	Novelis	PI	8/22 – 1/24
97	Data-Driven Physics-Based Modeling Tools to Determine Effective Mechanical Properties of As-Built Composite Structures	HiDeNN-AI, LLC	PI	7/22 – 2/23
96**	Design and Construction of a High throughput Oxidation Screening Test (HOST)	ARL	co-PI	6/22 – 5/23
95**	MRI: Development of multi-material printing and multi-modal sensing capabilities for directed energy deposition	NSF	Co-PI	9/22 – 8/24
94	Development of forming methods for closure panels using generic tools	GM	PI	1/22 – 1/23
93	Study of Distortion Reduction in Incremental Forming of High Strength Steels and Aluminum	GM	PI	10/21-12/22
92**	Integrating Materials and Manufacturing Development of Lightweight Alloys and Tribological solutions for UAS	ARL	PI***	9/21 – 9/24
91*	Multi-scale Metamorphic Manufacturing (MMM): Double-Sided Incremental Forming for Functional Metal Plates with Multi-scale Riblet Textures	ONR	PI	5/21 – 5/24
90**	Operator 4.0 via Fatigue and Motion Analyses in a Human Digital Twin Enabled Framework for Smart Manufacturing	MxD	PI*** co-PI	4/21 – 11/21 11/21 - 3/22
89	Methods of Incremental Forming of High Strength Steels and Aluminum Alloys with No Induced Distortion	GM	PI	3/21 – 2/22
88**	Enhancing Material Development and Manufacturing Technologies of Lightweight Alloys and Tribological Performances for Unmanned Aerial Systems	ARL	PI***	10/20 – 9/22
87**	NNCI: Soft and Hybrid Nanotechnology Experimental (SHyNE) Resource	NSF	Co-PI***	9/20 – 8/25

86**	Multi‐Scale Multi‐Material Printing of 3D Bead Arrays via Self‐Focused Electrohydrodynamic Jets	NSF	Co-PI	2/20 – 1/23
85	Manufacturing Process Compiler	DOD	PI***	9/19 – 8/24
84	NIST Center of Excellence: CHiMaD	NIST	Co-PI	6/19 – 12/24
83**	Tunable, Robust, Foul-resistant, Hybrid Hydrophobic-Hydrophilic (TuRF) Metasurfaces for High Temperature Heat Exchange Operations	DOE	Co-PI	10/19 –10/22
82	Tribological and Manufacturing Technologies for Unmanned Aerial Systems	ARL	PI	3/19 – 3/24
81	Planning Grant: Engineering Research Center for Democratizing Manufacturing Accessibility for Designers (DEMAND)	NSF	PI	9/18 – 8/19
80**	Rapid Electropulsing-Assisted Ultrasonic Dieless Incremental Forming with in-situ Surface Treatment	BIAM	PI	9/18 – 1/21
79**	Air Force 2030 Science and Technology Organizational and Process Study at Northwestern University	Air Force	Co-PI	3/18 – 9/18
78**	DOMinATE (Deployable Optical MembrAne Telescope)	NRO	Co-PI	2/18 – 2/21
77**	MASTER: Multiscale and data-driven modeling platform development with applications in advanced material simulation	BICI USA	Co-PI	6/17 – 11/18
76*	Modeling the Tool-Sheet Interface in Incremental Forming	Nissan	co-PI	9/17 – 3/18
75**	Correcting and Coating Thin Walled X-ray Optics via a Combination of Controlled Film Deposition and Magnetic Smart Materials	NASA	Co-PI	1/17 – 1/20
74**	CPS: Synergy: An Integrated Simulation and Process Control Platform for Distributed Manufacturing Process Chains	NSF	co-PI	12/16 – 11/20
73**	Rapid Process Certification and Verification for High-Value-Added and Low-Volume Production	DMDII	PI***	8/16 – 5/18
72**	OSCM: An Operating System for Cyberphysical Manufacturing	DMDII	PI	8/16 – 7/18
71*	Agile-1: Incremental Forming (subcontracted from LIFT, award being setup)	DoD	PI	8/16 – 7/18
70	I/UCRC Planning grant	NSF	PI	07/16 – 08/17
69**	NIAC: Further Development of Aperture: A Precise Extremely large Reflective Telescope Using Re-configurable Elements	NASA	co-PI	07/16 – 06/18
68**	Elastic-Cloud Based Make	DMDII	co-PI	04/16 – 03/17

67**	Magnetically-assisted laser-induced plasma micro-machining for flexible and fast texturing of functional surfaces	NSF	co-PI	06/16 – 05/20
66**	Electrically-Assisted Tubing Processes for Enhancing Manufacturability of Oxide Dispersion Strengthened Structural Materials for Nuclear Reactor Applications	DOE	PI	09/15 – 08/18
65**	Electric Field Guided Micro Additive Manufacturing Process	NSF	Co-PI	07/15 – 06/20
64	Understanding the effect of continuous electrical current on assisting material deformation and its resulting microstructure	NSF	PI	04/15 – 03/18
63**	NIST Center of Excellence: ChiMaD, $25 M in total	NIST		1/14 – 6/19
62**	Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles (subcontract from Ford)	DOE	PI***	10/14- 12/18
61**	MRI: Instrument Development: Additive Rapid Prototyping Instrument (ARPI)	NSF	Co-PI	7/14 – 6/17
60*	Development of Roadmap and Consortium for Innovation in Sheet Metal Forming	NIST	PI	6/14 – 5/18
59**	Hybrid Tri-pyramid Robot: A Novel Type of Double-Sided Incremental Forming Machine	NSF	PI	5/14 – 11/16
58**	3D Near Field e-Writing with Submicron Resolution	NSF	PI	6/14 – 5/18
57*	Manufacturing Processes Enhancement	Hu-Friedy	PI	1/14 – 12/16
56**	Development and Validation of Physics-Based Additive Manufacturing Models For Process Control and Quality Assurance	NIST	PI***	10/13 – 6/16
55*	Process Modeling and Enhancements of Laser-Induced Plasma Micro-Machining (LIP-MM)	NSF	Co-PI	9/13 – 8/15
54	Workshop on Future Research Needs in Advanced Manufacturing from Industrial Perspective; Arlington, Virginia; 11-13 August 2013	NSF	PI	3/13 – 2/14
53*	Rapid Freeform Sheet Metal Forming: Technology Development and System Verification (subcontracted from Ford)	DOE	PI***	7/13 – 03/16
52*	Curved Waterjet-Guided Laser Micro-Manufacturing	NSF	Co-PI	9/12-8/17
51**	EAGER: Cloud-Computing and High-Speed Internet Enabled Manufacturing	NSF	PI	9/11-8/13
50**	Improving the performance of X-ray optics with magnetostrictive films	NASA	co-PI	3/11 – 3/16
49	GOALI/Collaborative Research: Electrically-Enhanced Precision MicroRolling	NSF	PI	4/11 – 3/16

48*	Multi-Physics Based Micro Texturing (MP-M2) Technologies for Biomedical Products	KIMM	Co-PI	11/10 – 10/15
47	Study on Shaping Titanium Electrode	GE	PI	11/10-06/11
46	Friction Characterization of EDT sheets	Ford	PI	06/10- 09/10
45**	Engineering Bacteria-Proof Textured Steel Alloys for Medical Applications	Baxter	PI	09/10-08/11
44	A Hybrid Forming System: Electrical-Assisted Double Side Incremental Forming (EADSIF) Process for Enhanced Formability and Geometrical Flexibility	DOE	PI	07/10 – 01/12
43	Conference: The 2010 International Symposium on Flexible Automation; Tokyo; Japan; July 12 - 14, 2010	NSF	PI	03/10 – 06/11
42**	MRI: Development of a State-of-the-Art Laser Micro-machining and Surface Engineering System	NSF	Co-PI	9/09 – 8/11
41**	PFI: Laser-based Manufacturing and Materials Processing	NSF	co-PI	9/09 – 8/11
40	Variation Control in Micro-stamping	NSF	PI	9/09 – 8/13
39	Incremental Forming at Multi-scales – RET supplement	NSF	PI	9/08 -8/13
38	Exploratory Study on Shaping Titanium Electrode	GE	PI	4/09 – 6/09
37	Continuous Micro Roll Forming to Enable Energy Efficiency Devices	NU/ISEN	PI	5/09 – 9/ 09
36*	Collaborative Research: Deformation Machining - A New Hybrid Process – REU supplement	NSF	Co-PI	04/08 – 03/10
35	An Investigation of Surface Distortion of Line Dies - supplement	GM	PI	11/06-10/08
34*	GOALI/Collaborative Research: Integrated Sensing System for Stamping Monitoring and Control – supplement	NSF	PI	9/06 – 8/08
33**	A Bayesian Treatment of Uncertainty in Simulation-Based Methods for Enhancing Process and Product Robustness	NSF	Co-PI	06/08 – 06/12
32*	Collaborative Research: Deformation Machining - A New Hybrid Process	NSF	Co-PI	04/08 – 03/10
31	Incremental Forming at Multi-scales	NSF	PI	9/07-8/13
30**	NSF Summer Institute on Nano-Mechanics, Nano-Materials and Micro/Nano-Manufacturing	NSF	Co-PI	10/07-9/13
29*	Center for Multi-scale Virtual Design and Manufacturing	DOE/ ORNL	Co-PI	5/07-5/09
28**	CI-TEAM Implementation Project: Collaborative Research-A National Engineering Dissection Cyber-	NSF	Co-PI	1/07 – 12/08

	Collaboratory			
27	An Investigation of Surface Distortion of Line Dies	GM	PI	11/06-03/08
26*	Enhancing Interface Performance Through Surface Texturing	Boeing & Ford	PI	10/06 – 7/11
25*	GOALI/Collaborative Research: Integrated Sensing System for Stamping Monitoring and Control	NSF	PI	9/06 – 8/08
24**	Building a State-of-the-Art Laser-Based Surface-Texturing Instrument	NSF	Co-PI	9/06 – 8/08
23	SGER/GOALI/Collaborative Research: Deformation Machining - A New Hybrid Process	NSF	PI	5/06-4/08
22	Tool wear of high strength stamping die	Ford	PI	9/05 – 8/08
21	A Post-Process Tool for Detecting Surface Distortion in Stamping	GM	PI	11/05 – 10/06
20	Enhancing the understanding of the Fundamental Mechanisms of Thermostamping Woven Composites to Develop a Comprehensive Design Tool	NSF	PI	6/03 – 5/08
19	IREE Supplement to Collaborative Research: Enhancing the Understanding of the Fundamental Mechanisms of Thermostamping Woven Composites to Develop a Comprehensive Design Tool	NSF	PI	8/05-5/08
18	REU Supplement to Collaborative Research: Enhancing the Understanding of the Fundamental Mechanisms of Thermostamping Woven Composites to Develop a Comprehensive Design Tool	NSF	PI	4/04 – 5/08
17	Forming of Can Lid	REXAM	PI	9/02 – 6/03
16	Material Variability and Stamping Robustness	FORD	PI	03/02-02/05
15*	A Multi-Scale Approach for Predicting Wrinkling and its Experimental Validation	NSF	PI	09/01-08/04
14	Workshop on composite sheet forming	NSF	PI	05/01-11/01
13	An approach for model validation in simulating sheet metal forming processes	NSF	PI	09/00 - 2/02
12*	Intelligent material and process design for stamping of structural composites	NSF	Co-PI	04/99 - 03/02
11	CAREER: Tooling design and failure analysis in sheet metal forming	NSF	PI	07/97-06/02
10	A stress-based wrinkling criterion and its experimental verification	NSF	PI	09/97-08/01
9	Composite sheet forming	FORD	PI	
8	CAREER matching fund	FORD	PI	

7	A study on soft coil issue	MSC	PI	2001
6**	Design algorithm for optimizing stamping steps of axisymmetric parts	FORD	PI	2000
5	A simplified 2D model for predicting corner failure	GM	PI	07/97-01/99
4	Wrinkling prediction	GE	PI	3/97 - 12/98
3*	Springback Prediction	FORD	Co-PI	03/98-03/99
2	A study in sheet metal forming	ALCOA	PI	1997
1	A die design algorithm for stamping	NSF	PI	06/96-09/97
	TOTAL			
	Cao's TOTAL			

* Two PIs on this project.
** Multiple PIs on this project.
*** Multi-million dollar project.