Putong Kang

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Ph.D. Candidate, Department of Mechanical Engineering, Northwestern University

SUMMARY

Ph.D. Candidate in Mechanical Engineering with expertise in advanced manufacturing and prototyping of mechanical systems. Experienced in designing and executing experiments, developing CAD/simulation, and communicating complex technical results to diverse audiences. Skilled in bridging research and industry needs through hands-on problem solving, interdisciplinary collaboration, and delivering actionable insights for high-impact engineering challenges.

EDUCATION

Northwestern University Evanston, IL | Sept. 2020 – Feb. 2026 (Anticipated)

Ph.D., Mechanical Engineering, GPA: 3.97/4.00

Advanced Manufacturing Processes Laboratory, Advisor: Prof. Jian Cao, Prof. Kornel Ehmann

Dissertation Title: Process Innovations in Incremental Sheet Forming (ISF)

Duke University Durham, NC | Aug. 2018 - May 2020

MSc, Mechanical Engineering and Materials Science, GPA: 4.00/4.00

Acoustofluidics Lab, Advisor: Prof. Tony Jun Huang

Thesis: Acoustic tweezers based on circular, slanted-finger interdigital transducers for dynamic manipulation of micro-objects

Harbin Institute of Technology Harbin, CHINA | Sept. 2013 - Jul. 2018

B. Eng., Power Engineering, GPA: 88.4/100

Thesis: Nonlinear characteristic analysis of flame stabilization with plasma-assisted

PROFESSIONAL EXPERIENCE

General Motors Warren, MI | Aug. 2022 – Jun. 2023

Visiting Researcher

- Automated the traditional power hammer forming process by integrating FANUC robotics with Abaqus simulations, reducing reliance on scarce manual expertise.
- Performed springback analysis in Abaqus and experimental parameter optimization to improve forming quality and repeatability, cutting labor time by >70%.
- Designed and built a new experimental setup with high-speed imaging and computer vision to measure impact speed, enabling quantitative validation of forming dynamics.
- Communicated findings to engineers, R&D staff, and managers, positioning robotic forming as a scalable digital manufacturing solution for the automotive sector.

Northwestern University, Mechanical Engineering

PIs: Prof. Jian Cao and Prof. Kornel Ehmann

Ph.D. Research Assistant

Research on texture-induced morphing for innovative sheet metal forming Aug. 2024 – Present

- Applied Incremental Sheet Forming (ISF) to create surface textures that drove controlled morphing of sheet geometries under boundary modification.
- Combined theoretical models and experiments to analyze morphing behavior across forming parameters, contributing to new design strategies for shape control.

Research on mold liners produced by incremental sheet forming Jun. 2024 – Mar. 2025

- Investigated ISF as a method for producing mold liners for small-scale molding systems.
- Designed toolpath strategies based on tooltip geometry and feature skeletons to fabricate high-quality textures and features.
- Demonstrated improved demolding performance and surface finish over stereolithography (SLA)-printed molds using PDMS, with potential for broader material compatibility.

Research on the geometric accuracy of a complex shape with incremental sheet forming Oct. 2023 – Apr. 2025

- Contributed to the Benchmark 2024 project with 13 institutes, executing Double-sided Incremental Forming (DSIF) experiments, collecting multi-institute data, and analyzing geometric deviations.
- Investigated accuracy improvements in Single-Point Incremental Forming (SPIF), Two-Point Incremental Forming (TPIF), and DSIF processes through controlled testing and data-driven comparison.

Research on hierarchical surface textures for improved coating durability Aug. 2023 – Dec. 2024

- Investigated the role of surface texturing via DSIF in enhancing the durability of Slippery Liquid-Infused Porous Surfaces (SLIPS) coatings on metal substrates.
- Developed a new method that integrates shape forming and surface micro-texturing using universal tools, reducing manufacturing complexity.
- Demonstrated that discretized dimple textures and low-speed tool spinning improve lubricant retention, self-healing capability, and surface hydrophobicity.

Research on automating the English Wheel Process using UR5 robots Aug. 2023 – Jun. 2024

- Designed a robotic English wheel system with custom gripper, real-time force sensing, and adaptive toolpath control with UR5 robots handling sheet metals.
- Delivered improved repeatability and forming mechanics insight, advancing digital manufacturing and Industry 4.0 automation.
- Mentored undergraduates in design, prototyping, and validation of the robotic system.

Research on Double-Sided Incremental Forming for manufacturing shell structure Sept. 2021 – Jun. 2023

- Developed a novel DSIF-based manufacturing process for unmanned underwater vehicle (UUV) hulls with integrated drag-reducing and anti-biofouling textures.
- Leveraged dual toolpath strategies to fabricate riblet textures and applied SLIPS coatings, achieving improved hydrodynamic performance and coating durability.
- Demonstrated an agile, tool-free approach to low-volume shell structure production, enabling point-of-need digital manufacturing for functional marine components.

Research on Laser-Induced Plasma Micro-Machining (LIPMM) Sept. 2020 – Sept. 2021

- Optimized a new micromachining process through experimental methods, improving machining precision and repeatability by reducing the heat-affected zones.
- Studied the effect of surfactants and external magnetic fields on machining quality, establishing guidelines for process control.

Duke University, Mechanical Engineering and Materials Science

PI: Prof. Tony Jun Huang

Research Assistant

Frequency-multiplexed Acoustic tweezers for manipulation of microparticles Sept. 2018 – Mar. 2020

- Designed and optimized 3D acoustic tweezers with innovative transducer layouts for dynamic manipulation of microparticles and cells, combining experimental testing with simulation.

- Implemented frequency-multiplexing strategies to expand manipulation capabilities, improving device precision and throughput by tuning the excitation frequency over a wide range.
- Conducted hands-on prototyping, microfabrication, and performance testing, advancing lab-on-a-chip applications for biomedical research.

AWARDS

- Office of Graduate and Postdoctoral Success (GPS) Bridge Fellowship, Northwestern University (2025)
- NSF Student/Early Career Researcher Travel Award, National Science Foundation (2025)
- The Environmental Engineering and Sustainability Program (ENG/CBET) award, National Science Foundation (2024)
- The Conference Travel Grant (CTG), Northwestern University (2024 / 2025)
- Most Valuable Player award of Advanced Manufacturing Processes Laboratory, Northwestern University (2021 / 2025)
- Predictive Science and Engineering Design (PSED) Fellowship, Northwestern University (2021)
- Walter P. Murphy Fellowship, Northwestern University (2020)
- Outstanding Graduate of Harbin Institute of Technology (2018)
- Merit Student of Harbin Institute of Technology (2015-2016 / 2016-2017)

PUBLICATIONS

[1] **Kang, P.**, Wadman, B., Ehmann, K., & Cao, J. (2025). Mold liners produced by incremental sheet forming. *CIRP Annals*, *74*(1), 363-367.

[2] **Kang, P.**, Huang, S., Feng, L., Ehmann, K., & Cao, J. (2025). Hierarchical Surface Textures for Improved Coating Durability Using Double-Sided Incremental Forming. *Journal of Manufacturing Science and Engineering*, *147*(8): 081004.

[3] Vanhulst, M., Lee, Y., Steinfels, D., … **Kang, P.**, … Madej, L., & Duflou, J. (2025). ESAFORM benchmark 2024: Study on the geometric accuracy of a complex shape with Single Point Incremental Forming. *International Journal of Material Forming*, *18*(3), 72.

[4] Suarez, D., Chen, F., **Kang, P.**, Forbes, B., Gao, M., Ineza, O., Benton, K, Dewberry, N, Jaiswal, C, Gokaraju, B, Ehmann, K., & Cao, J. (2024). On the feasibility of an integrated English wheel system. *Journal of Manufacturing Systems*, *74*, 665-675.

[5] **Kang, P.**, Huang, S., Beckle, B., Cifuentes, E., Feng, L., Park, K, Ehmann, K., & Cao, J. (2023). Toolmarks-Driven Surface Texture for Coating Attachment with Drag Reduction and Anti-Biofouling Performance, In *International Manufacturing Science and Engineering Conference (Vol. 87240, p. V002T06A023).* American Society of Mechanical Engineers.

[6] Huang, D., Suarez, D., **Kang, P.**, Ehmann, K., & Cao, J. (2023). Robot forming: automated English wheel as an avenue for flexibility and repeatability, *51st SME North American Manufacturing Research Conference.*

[7] Bhandari, S., **Kang, P**., Jeong, J., Cao, J., & Ehmann, K. (2022). Cavitation bubble removal by surfactants in Laser-Induced Plasma Micromachining. *Manufacturing Letters*, *32*, 96-99.

[8] Zhao, S., Huang, P. H., Zhang, H., Rich, J., Bachman, H., Ye, J., Zhang, W., Chen, C., Xie, Z., Tian, Z., **Kang, P.**, Fu, H., & Huang, T. J. (2021). Fabrication of tunable, high-molecular-weight polymeric nanoparticles via ultrafast Acoustofluidics micromixing. *Lab on a Chip*, *21*(12), 2453-2463.

[9] Zhu, H., Zhang, P., Zhong, Z., Xia, J., Rich, J., Mai, J., Su, X., Tian Z., Bachman, H., Rufo, J., Gu, Y., **Kang, P.**, Chakrabarty, K., Witelski, T., & Huang, T. J. (2021). Acoustohydrodynamic tweezers via spatial arrangement of streaming vortices. *Science advances*, *7*(2), eabc7885.

[10] **Kang, P.**, Tian, Z., Yang, S., Yu, W., Zhu, H., Bachman, H., Zhao, S., Zhang, P., Wang, Z., Zhong, R., & Huang, T. J. (2020). Acoustic tweezers based on circular, slanted-finger interdigital transducers for dynamic manipulation of micro-objects. *Lab on a Chip*, *20*(5), 987-994.

[11] Kang, J., Wang, J., Ni, H., & **Kang, P.** (2020). Study on two-dimensional numerical simulation of rainstorm and torrent in small watershed based on lidar data. *Journal of Hydrologic Engineering*, 25(9), 04020044.

[12] Tang, J., Tang, M., Zhou, D., **Kang, P.**, Zhu, X., & Zhang, C. (2019). Hysteresis characteristics of the initiating and extinguishing boundaries in a nanosecond pulsed DBD. *Plasma Science and Technology*, *21*(4), 044001.

[13] Zhou, D., Tang, J., **Kang, P.**, Wei, L., & Zhang, C. (2018). Effects of magnetic field intensity on ionic wind characteristics. *Journal of Electrostatics*, *96*, 99-103.

PUBLICATIONS UNDER PREPARATION

[1] Nguyen, N., **Kang, P.**, Hu, F., & Cao, J. Microstructure evolution and corrosion resistance of 316L stainless steel by Double-Sided Incremental Forming. *To Be Determined,* will be submitted in early 2026.

[2] Malakpour, S., Wadman, B., Quispe, D., **Kang, P.**, & Cao, J. Transfer Learning Enabled Geometry and Material Agnostic Graph Neural Network for the Simultaneous Prediction of Final Geometry and Force in Double Sided Incremental Forming. *To Be Determined,* will be submitted in early 2026.

[3] **Kang, P.**, Cao, J. Programmable Surface Morphing Using Incremental Sheet Forming. In preparation.

[4] **Kang, P.**, Malakpour, S., Ehmann, K., & Cao, J. CadMeshCNN: An incremental forming strategy for geometries with multiple features. In preparation.

PRESENTATIONS

[1] Title: *Toolmarks-Driven Surface Texture for Coating Attachment with Drag Reduction and Anti-Biofouling Performance,* presented at ASME Manufacturing Science and Engineering Conference (MSEC), June 12–16, 2023, New Brunswick, USA.

[2] Title: *Microstructure evolution and corrosion resistance of 316L stainless steel by Double-Sided Incremental Forming*, presented as a coauthor at The Minerals, Metals & Materials Society (TMS) Specialty Congress 2024, June 16–20, 2024, Cleveland, USA.

[3] Title: *Process Innovations in Incremental Sheet Forming (ISF),* presented at 53rd SME North American Manufacturing Research Conference (NAMRC), June 23-27, 2025, Clemson, USA.

[4] Title: *Distortion Reduction Utilizing the English Wheel,* work presented at NUMISHEET 2025 by the lead author, July 7-11, 2025, Munich, Germany.

RESEARCH MENTORSHIP

[1] Brett Wadman, Ph.D. student, Sep. 2024 - current, Junior Ph.D. research mentorship on incremental sheet forming.

[2] Shengke Huang, MS, Sept. 2021 – Dec. 2023, Graduate research assistant, Thesis: *Functional Surface Forming by Double-Sided Incremental Forming.*

[3] Songlin Duan, MS, Sept. 2021 – May. 2023, Graduate research assistant, Thesis: *Forming Force Prediction in Double-Sided Incremental Forming via GNN-Based Transfer Learning.*

[4] Ainhoa Odriozola Alberdi, MS, Summer 2022, Visiting student, Research topic: *Hydrodynamic analysis for a UUV fabricated by DSIF technology.*

[5] Michelle Zhang, BS, Oct. 2023 – May. 2024, Undergraduate research assistant, Research topic: *Molding Research by Incremental Sheet Forming.*

SKILLS AND OTHERS

Analysis & Simulation: Finite element analysis (Abaqus, Ansys, COMSOL), data analysis (MATLAB, Python, C)
CAD & Design: 3D modeling and engineering drawings (SOLIDWORKS, AutoCAD, Siemens NX)
Laboratory & Experimental: Mechanical testing, SEM, tribology, rapid prototyping, machining, custom experimental setup design (high-speed imaging, force sensing, etc.)
Programming & Automation: LabVIEW, Delta Tau controller, FANUC robotics, process automation, computer vision
Languages: English (full professional proficiency); Mandarin (native)
Affiliations: Student member, American Society of Mechanical Engineers (ASME)
Interests: Jogging, cycling, hiking, badminton, photography, Chinese calligraphy, and reading detective novels