

Exponent®
Engineering & Scientific Consulting

Kate Cheng, Ph.D., P.E.

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Professional Profile

Dr. Cheng specializes in the technical analysis of software-controlled mechanical systems. She assists clients with the evaluation of complex products and systems through engineering analysis, testing, and review of software, technical documentation, industry standards, and regulatory requirements.

Dr. Cheng leverages her expertise in the mechanical, electrical, and software domains to address technical issues that span multiple disciplines in failure investigations, intellectual property disputes, and product litigation. Her experience encompasses industrial equipment, automotive, rail, aerospace, power generation equipment, and consumer products.

Controls and Embedded Software

Dr. Cheng has extensive experience reviewing the control logic, calibration, and system requirements in electromechanical systems where physical system behavior depends on software and control decisions. Her work includes reviewing source code, documentation, and specifications across the transportation, manufacturing, industrial, and consumer product sectors. She regularly reviews the integration of sensors, actuators, and safety-related devices used in industrial machinery. She has particular expertise in reviewing control systems related to diesel engine aftertreatment systems and experimental validation of software functionality.

Intellectual Property

Dr. Cheng assists clients in evaluating patent infringement, validity, and trade secret matters, as well as intellectual property due diligence investigations. She also utilizes her experience in mechanical analysis and source code review to assist in claim construction, assessment of design-arounds, and evaluation of prior art. She has conducted investigations of consumer products and electronics, automated and industrial equipment, manufacturing processes, power generation machinery, and sports and recreational equipment.

Safety and Failure Investigations

Dr. Cheng has performed numerous inspections and engineering analyses of consumer and industrial products and components. Her work includes evaluating product defects and failure mechanisms, reviewing design and manufacturing documentation, assessing maintenance and inspection records, and applying relevant industry standards. She reviews interactions between mechanical, electrical, and software components in assessing failures, safety, and product performance. Her experience spans industrial equipment, robotics and automation systems, machine guarding systems, transportation equipment, and system integration.

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Prior to joining Exponent, Dr. Cheng completed her Ph.D. at Northwestern University, where her research focused on computational and analytical modeling of material deformation and advanced metal and composite manufacturing processes. Her work included toolpath sequencing and design for metal additive manufacturing and incremental sheet metal forming processes. She has experience in thermal and mechanical finite element analysis (FEA) for modeling plasticity, damage, and microstructure evolution. She performed research in collaboration with Ford Motor Company to develop software for modeling the deformation and failure of carbon fiber composites. In addition, Dr. Cheng has experience with textile manufacturing equipment, including weaving, fiber-spinning, and sewing systems. She also conducted experimental work at the Argonne National Laboratory high energy x-ray light source facility to investigate the material properties of 3D printed metals. In addition, Dr. Cheng has experience with textile manufacturing equipment, including weaving, fiber-spinning, and sewing systems.She has experience in data analysis, parallel and high-performance computing, image processing, data visualization, data acquisition, and experiment design.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Northwestern University, 2020

M.S., Mechanical Engineering, Northwestern University, 2017

B.S., Mechanical Engineering, California Institute of Technology (Caltech), 2014

Licenses and Certifications

Professional Engineer, Illinois, #062074128

Prior Experience

Guest Researcher, National Institute for Standards and Technology, 2020

Professional Affiliations

American Society for Testing and Materials (ASTM)

American Society of Mechanical Engineers (ASME)

Languages

Cantonese Chinese

Publications

Cheng P, Liu WK, Ehmann K, Cao J. "Enumeration of additive manufacturing toolpaths using Hamiltonian paths." Manufacturing Letters. 2020; 26:29-32.

Cheng P. Toolpath Design for Additive Manufacturing Using Graph Theory. Ph. D. Dissertation, Northwestern University, 2020.

Ndip-Agbor E, Cheng P, Moser N, Ehmann K, Cao J. Prediction of rigid body motion in multi-pass single point incremental forming. Journal of Materials processing Technology. 2019 Jul 1;269:117-27.

Smith J, Xiong W, Yan W, Lin S, Cheng P, Kafka OL, Wagner GJ, Cao J, Liu WK. "Linking process, structure, property, and performance for metal-based additive manufacturing: computational approaches with experimental support." Computational Mechanics. 2016 Apr 1;57(4):583-610.

Additional Education & Training

Certificate in Research Communication, Northwestern University

Management for Scientists and Engineers Certificate, Northwestern University

Predictive Science & Engineering Design Certificate, Northwestern University