



HAROLD AND INGE MARCUS  
DEPARTMENT OF INDUSTRIAL AND  
MANUFACTURING ENGINEERING

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## Industrial engineer earns NSF CAREER Award

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UNIVERSITY PARK, Pa. — Hui Yang, Harold and Inge Marcus Career Associate Professor of Industrial and Manufacturing Engineering, was recently awarded a National Science Foundation (NSF) Early Career Development (CAREER) Award.

The CAREER award is the most prestigious award given by the NSF and is designed to support junior faculty members who have shown exceptional promise through outstanding research, excellent teaching and the integration of education and research by awarding assistant professors with five years of funding.

Yang received a \$500,000 grant for his project titled “Sensor-based Modeling and Control of Nonlinear Dynamics in Complex Systems for Quality Improvements in Manufacturing and Healthcare.”

Many industries, including manufacturing and health care, have identified the urgent need to harness and exploit nonlinear dynamics—arising whenever multifarious entities of a system cooperate, compete, or interfere—to introduce creative new products or services with remarkable features, such as adaptation, customization, responsiveness and quality in unprecedented scales.

Yang’s research aims to advance the scientific base of modeling and control of these complex systems by contributing new nonlinear dynamics concepts, methods and algorithms. Effective monitoring and control of nonlinear dynamics will increase system quality and integrity, thereby leading to significant economic and societal impacts.

“This research will enrich the theory of nonlinear dynamics and expand its research domain to interdisciplinary applications in both manufacturing and health care sectors,” said Yang. “The methodologies are also generally applicable to a wide variety of complex systems that exhibit nonlinear dynamics such as the heart and the brain, as well as precision machining, biomanufacturing and nanomanufacturing.”

Successes in smart health and advanced manufacturing require a highly skilled workforce capable of using and developing advanced quality technologies. However, most engineering curricula do not provide college graduates with the knowledge and training in sensor-based modeling of nonlinear dynamics phenomena. Yang’s CAREER education plan is aimed at training the next generation of engineers to bring analytical skills and nonlinear thinking into advanced sensing and process control. He aims to integrate his research efforts with educational and outreach activities for students at various levels, as well as inform the general public on a wide variety of nonlinear phenomena in complex systems.

Yang joined the Penn State faculty in August 2015. His research interests include: sensor-based modeling and analysis of complex systems for process monitoring/control; system diagnostics/prognostics; and quality improvement and performance optimization, with a special focus on nonlinear stochastic dynamics and the resulting chaotic, reoccurring, multifractal, self-organizing, long-range behavior.

He is specifically interested in the study of complex systems monitoring, healthcare informatics and signal processing, big data analytics for large-scale complex systems, nonlinear dynamics and chaos, computer simulation and optimization, and quality engineering and applied statistics.

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Hui Yang

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