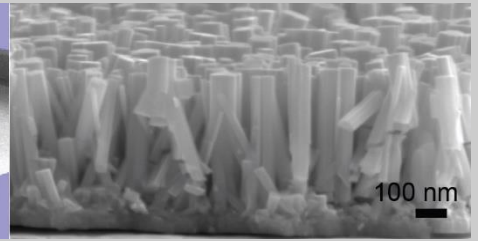
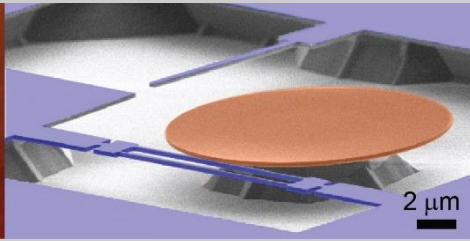
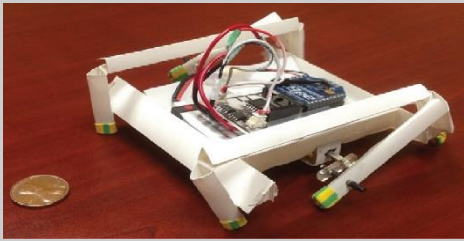




WPI

MECHANICAL ENGINEERING



WPI ME Graduate Seminar Series 2019-2020

Novel Manufacturing Process and Equipment Inspired by Applied Physics: From Structural Coloration to Self-Levitation

Ping Guo, Ph.D.

Assistant Professor, Mechanical Engineering
Northwestern University

10:00-10:50 am, Wednesday, April 8

Zoom: <https://wpi.zoom.us/j/341849617>

About the Speaker



Historically, advancement in manufacturing technology has frequently led to scientific breakthroughs, revolutionary product design, and creation of new consumer markets. These technological improvements can be categorized into two groups: incremental upgrades of the traditional approaches, and disruptive innovation involving outside-the-box thinking. In this talk, I will present my research efforts of the past few years in creating new and enhanced manufacturing processes and equipment utilizing non-traditional physical principles. Particularly, two examples will be presented to demonstrate outside-the-box thinking in innovation. The first example introduces a novel vibration-assisted machining method for fast creation of controllable micro/nano-gratings for structural coloration. When the tool vibration is coupled with a constant cutting velocity, periodic ripples can be generated due to the machining marks. These periodic ripples, whose wavelength is in the visible spectrum, can introduce iridescent colors. The device design, theoretical analysis, experimental results, and potential applications of the process, such as high-resolution image marking and anti-counterfeiting, will be discussed in detail. In the second example, I will briefly introduce a new design of a self-levitated surface motor which only relies on its structural vibration. The floating mechanism is based on near-field acoustic levitation, a.k.a., squeeze film levitation; while the two-dimensional moving mechanism is based on the controlled pressure distribution within the thin air film using coupled resonant modes. The envisioned applications include non-contact bearings for precision machine tools, non-contact

Dr. Ping Guo is an Assistant Professor at the Department of Mechanical Engineering, Northwestern University. He received his B.S. degree in Automotive Engineering from Tsinghua University in 2009 and his Ph.D. degree in Mechanical Engineering from Northwestern University in 2014. Before joining Northwestern University in September 2018, he spent four years at the Chinese University of Hong Kong as an assistant professor. Dr. Guo's research interests center on the paradigm of micro/meso-scale manufacturing, including surface texturing, process micro-mechanics, miniature machine tools, micro-additive manufacturing, etc. He serves as an associate editor for *SME Journal of Manufacturing Processes* and an editorial board member of *Manufacturing Letters*. He is the recipient of Outstanding Young Manufacturing Engineer Award from SME (2020), Young Investigator Award from International Symposium on Flexible

measurement in metrology, and next-generation levitation mobile robots. Finally, I will discuss some other interesting projects in my research group, my future research directions, and their potential impacts on future advanced manufacturing.

Automation (2018), Hong Kong Research Grants Council Early Career Award (2016), and the Best Paper Awards of International Conference on NanoManufacturing (2016) and International Conference on MicroManufacturing (2013).