SEMINAR SERIES

北京大学工学院 先进制造与机器人系

Machine Learning for Freeform MEMS Structure Design

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Abstract:

The geometric designs of MEMS devices can profoundly impact their physical properties and eventual performances. However, it is challenging for researchers to rationally consider a large number of possible designs, as it would be very time- and resource-consuming to study all these cases using numerical simulation. We report the use of deep learning techniques to accelerate the MEMS design cycle by quickly and accurately predicting the physical properties of numerous design candidates with vastly different geometric features. Design candidates are represented in a nonparameterized, topologically unconstrained form using pixelated black-and-white images. After sufficient training, a deep neural network can quickly calculate the physical properties of interest with good accuracy without using conventional numerical tools such as finite element analysis. As an example, we apply our deep learning approach in the prediction of the modal frequency and quality factor of disk-shaped microscale resonators. With reasonable training, our deep learning neural network becomes high-speed, high-accuracy calculator for the inverse designs. The proposed technique can rapidly screen over thousands of design candidates and promotes experience-free and data-driven MEMS structural designs towards targeted performances.

Biography:

Dr. Ruiqi Guo is currently a postdoctoral researcher at RIKEN in Japan, working under the supervision of Professor Takao Someya. He earned his Bachelor's degree in Automotive Engineering from Beihang University in 2018 and completed his Ph.D. in Mechanical Engineering at the University of California, Berkeley, in 2022, under the guidance of Professor Liwei Lin. His primary research focus is on "AI for Science and Engineering."

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