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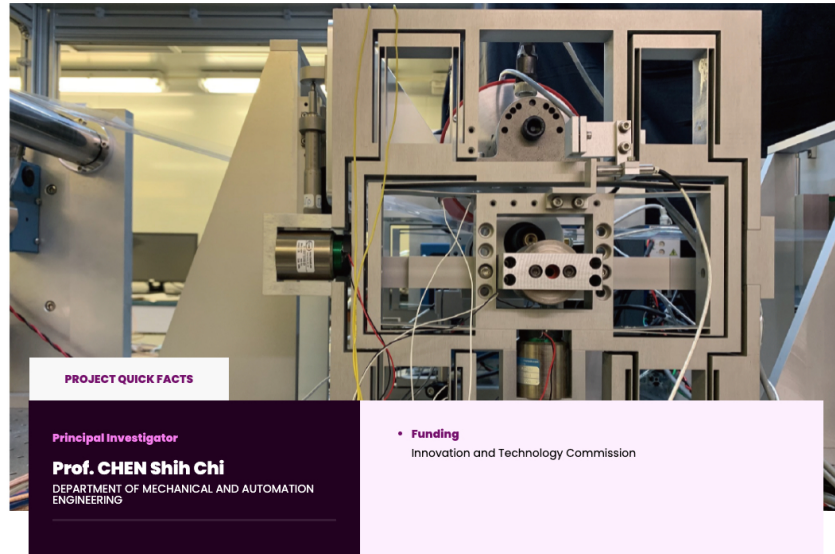
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Deep Learning for Next-Generation Precision Machine Tools and Manufacturing

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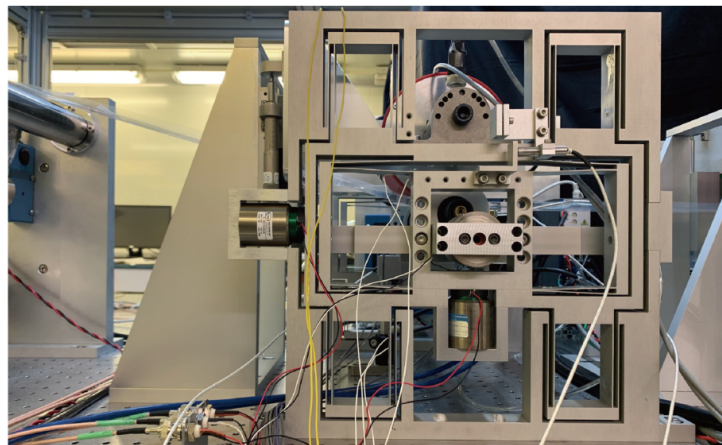
#2019



Positioning and robotic technologies are essential elements for large-scale automated manufacturing. However, the existing robotic platforms only allow robots to perform routine and simple assembly processes with low precision (100s μm – mm scale), which sensors applied in these platforms are very expensive. Combining deep learning with precision engineering principles to improve efficiency and accuracy, we develop next-generation precision machines and robotic platforms for low-cost, high-precision manufacturing.

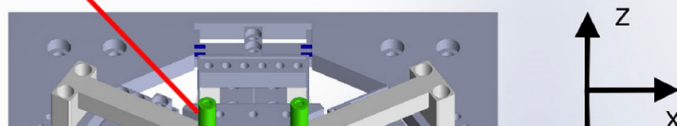
Uniqueness and Competitive Advantages:

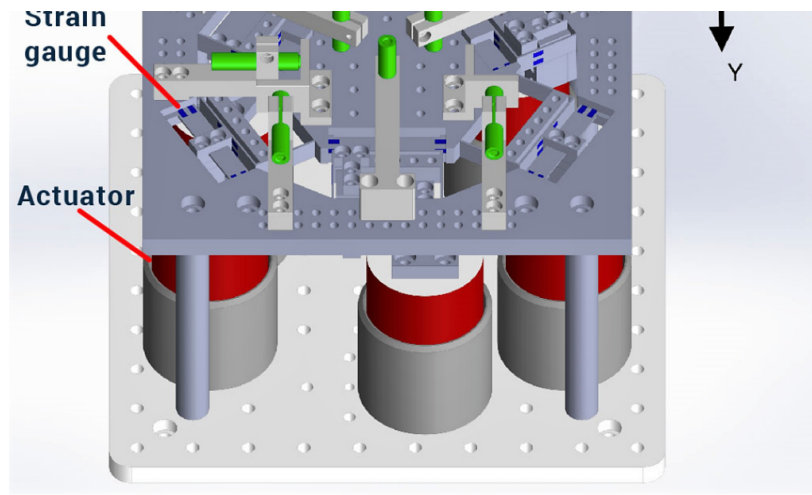
- We propose to use low-cost strain gauges to replace costly capacitance probes used in conventional systems.
- Deep learning algorithms enable learning and prediction of machine behavior. At the training stage, high-precision sensors are used as a reference to minimize position errors; while the number and location of sensor arrays and actuators are optimized through the deep learning model.
- Though effectively combining deterministic and statistical approaches, low-cost sensor arrays and actuators installed can predict machine behavior with 10s nm to submicron level precision.



Roll-to-Roll system mounted with multiple strain sensor arrays to control X-Y directional movement

Cap probe





Six-axis model mounted with low-cost strain sensor array instead of capacitance sensors

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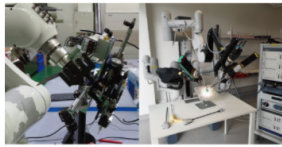
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