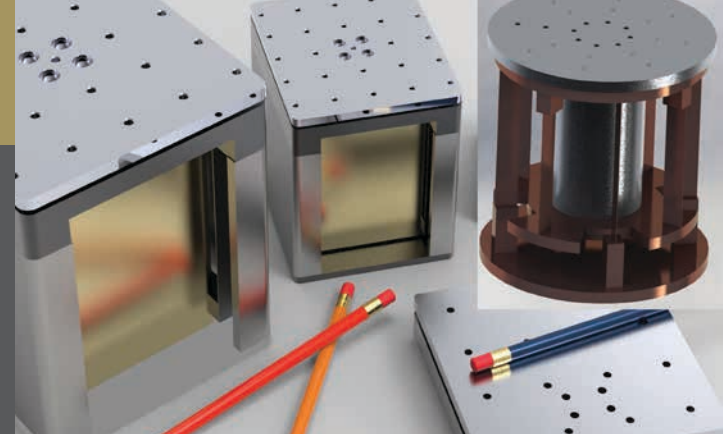


Compliant Mechanisms for Ultra-Precision Linear and Rotary Motion Control



Problem Statement: As technology advances, its application in specific domains like aerospace and defence also need critical systems. Further, in the manufacturing industry too, micro-3D printing and micro-milling are upcoming technologies that fuel research at the microscale to translate into devices beneficial for society. The micro-nanopositioning of critical optical systems is one such application. Ultra-high-precision positioning in the nanometric accuracy levels is infeasible with conventional ball guided stages because of friction. The use of piezo actuators limits the travel range. The magnetic levitation-based stages are expensive and energy-intensive and need to be imported. Thus, researchers at IIT Bombay are exploring compliant robots for high-speed, lightweight applications. The proposed compliant mechanism technology can be futuristic in this domain.

Uniqueness of the Solution: The

proposed innovative solution uses compliant mechanisms and their variants. Compliant mechanisms are inherently friction-free, backlash-free and need no lubricants. There is no wear and tear and maintenance with frictionless motion, and calibration is less frequent. The products thus promise long life with a high degree of reliability. The challenges posed are in terms of parasitic errors, fabrication, mechatronics and control. These have been resolved using the research work done during the development of this technology.

Current Status of Technology:

Several systems and prototypes for multiple applications (micro 3D printing, micro-milling, micro UTM) has been developed based on this technology and tested in the laboratory successfully.

Societal Impact: A part of the technology has been licensed to two companies, and one of them received a prestigious FIE Foundation award at IMTEX 2019.

The group founded a startup company Flexmotion Technologies for better translation into commercial products.

Patent(s): Filed and Granted

Relevant Industries: Defence, Aerospace, Robotics, Manufacturing, Semiconductor Equipments.

Faculty: Prof. Prasanna Gandhi, Mechanical Engineering.