Multi-DOF Manipulator with Force Feedback for Target Assembly of HEDS Targets

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Full Manipulator Design

Force/Torque Feedback Manipulator Design

Semi-Kinematic Mounting System

Summary

The design of a multiple degree-of-freedom manipulator intended for high Precision assembly of millimeter-scale parts is presented. The manipulator has six degrees of freedom with a 12.5-mm range in the five translation axes and a full 360-degree rotation about the z axis. Sensors measuring a-axis displacement (100-mm resolution) and force/torquer sensor (3.9-mV and 30-mV/mm resolution) increase the precision and control. The FT system can be used to improve the quality and yield of foam assemblies.

Force (mN) vs Displacement (µm)

Foam Indentation Tests

Indention tests of foams were used to verify the ability of the FT system to measure foam deformation during assembly.

Ongoing and future work:
- Assembly of foam assemblies
- Force-deformation curves for custom foams

Other potential uses:
- Planar assemblies with and without foam
- Mating of foams without low density regions through increased yield and torque variations during foam assembly due to foam deformation.

Future Work

Bearing ratios can be used to characterize foam high spots. Successive pressing and measurement could tell us when we have crushed the high spots but not yet cracked the underlying part.

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