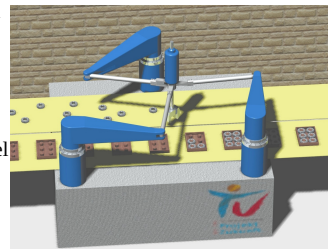
Parallel Manipulators
Chairs: David Cannon, F. C. Park

A Mixed Elastic and Rigid-Body Dynamic Model of an Actuation Redundant Parallel Robot with High-Reduction Gears
S. Kock and W. Schumacher
Technical University Braunschweig

- New redundantly actuated parallel manipulator with gearboxes
- Rigid-body cartesian model for motion d.o.f.
- Decoupled elastic null space model for force d.o.f.
- Experimental validation allowing full feedback control



Control of a Fast Parallel Robot with a Redundant Chain and Gearboxes: Experimental Results
S. Kock and W. Schumacher
Technical University Braunschweig

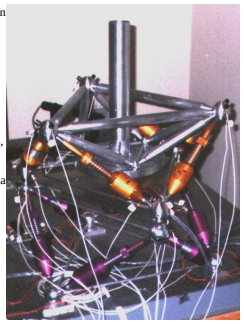
- Parallel manipulator prototype with force redundancy
- Internal force sensors, feedback control of null space torques
- Experimental results with high accelerations (> 10 g)
- Video shows high-speed pick-and-place application

Application of a Nonlinear Adaptive Controller to a 6 dof Parallel Manipulator
M. Honegger, R. Brega and G. Schweitzer
Swiss Federal Institute of Technology

- The dynamics of this parallel manipulator is highly nonlinear
- A nonlinear motion controller was successfully applied
- Adaptive algorithms identify dynamic parameters on-line
- A fast CPU and a novel hard real-time OS were required

Identification and Decoupling Control of Flexure Jointed Hexapods
Yixin Chen and John McInroy
University of Wyoming

- Flexure jointed hexapods, or Stewart platforms, are developed for micro-precision applications. A flexure joint bends material to achieve motion, rather than sliding or rolling across two surfaces. This does eliminate friction and backlash, but adds spring dynamics and limits the workspace. The linearized dynamic model is a highly coupled MIMO model.
- Decoupling the MIMO model into independent channels can greatly simplify the compensator design, and facilitate SISO adaptive and nonlinear algorithms. Previous decoupling methods impose severe constraints on the allowable geometry, workspace, and payload. The new approach removes these constraints, thus greatly expanding the potential applications.
- The new decoupling method is based on diagonalizing the joint space mass-inertia matrix. An identification algorithm is introduced to identify the joint space mass-inertia matrix using payload accelerations and base forces. This algorithm can be used for precision payload calibration, thus improving performance and removing the labor required to design the control for different payloads.
- The new decoupling algorithm is experimentally compared to earlier techniques. These experimental results indicate that the new approach is practical, and improves performance. Using the new decoupling method, nearly 20dB decoupling across all frequencies is achieved.



Elasto-Kinematic Analysis of Parallel Mechanisms
J. Kim[1], F. C. Park[1] and M. Kim[2]
[1]Seoul National University and [2]Korea Institute of Science and Technology

Optimal Force Distribution Applied to Robotic Crane with Flexible Cables
Wei-Jung Shiang, David Cannon and Jason Gorman
Pennsylvania State University