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Compliance Control for Robotic In-Space Assembly and Maintenance

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Abstract

NASA is developing in-space, satellite-servicing capabilities that will include capture and refueling by robots. The necessary operations will require responsiveness to contact forces and moments. With communications delays, force-reflecting haptics for teleoperation is impractical. Instead, the robot must be responsible for compliant-motion behaviors essential to success, while the Earth-based human operator provides supervisory control. Particular challenges for space-based, compliant-motion controlled robots include: servo controller sample rate limitations, servo controller feedback latency, and non-collocated force feedback. Subject to these non-idealities, it is essential to guarantee contact stability under compliant-motion control. Additionally, given compliant-motion capability, one must identify and develop higher-level robot behaviors that are useful for achieving manipulation goals and which are intuitive to a remote supervisory human controller. This presentation will review techniques for assuring contact stability as well as behaviors appropriate for supervisory control of manipulation.