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Aiming for perfection in spacecraft jitter mitigation and vibration isolation

The actuators for spacecraft attitude control systems usually use reaction wheels or control moment gyros (CMG's). Slight imbalance in the wheels produces spacecraft jitter that adversely affects pointing accuracy. The new field of satellite laser communication between spacecraft and between spacecraft and ground pushes the importance of effective methods for addressing the resulting jitter. NASA JPL has developed a high-precision laser system that can span interplanetary distances with millimeter accuracy that can help send messages at high data rates at large interplanetary distances. The LADEE spacecraft recently accomplished at "record shattering" data download rate of 622 megabits per second from the moon. The field of repetitive control is specifically designed to learn to cancel periodic disturbances to control systems. It can be applied to the mirror of the outgoing laser to learning to adjust pan and tilt to cancel the influence of jitter on laser pointing. This presentation examines the issues and methods involved in adjusting the parameters of repetitive control systems to eliminate the maximum amount of jitter from the beam.

Biography

Richard W Longman is a Professor of Mechanical and Civil Engineering at Columbia University. He is a Distinguished Romberg Guest Professor for University of Heidelberg, Germany. He received a 50,000 Euro Award for lifetime achievement in research from the Alexander von Humboldt Foundation and the Dirk Brouwer Award from the American Astronautical Society (AAS) for contributions to spaceflight mechanics. His obtained his PhD from the University of California, San Diego. He has co-authored approximately 450 publications.

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