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On the problem of jitter in spacecraft

Spacecraft often require very accurate pointing. An extreme example is the Hubble Space Telescope whose design requirement was pointing to within 5 thousandth of an arc seconds. A new technology requiring accurate pointing is LaserCom currently being studied by NASA. It uses a laser beam instead of the usual antennae for the purpose of vastly increasing the bandwidth of communication channels. If LaserCom can be used for interplanetary communication to Mars, real time high definition television images could be transferred. However, the attitude or rotational control systems for spacecraft need actuators that involve rotating wheels-reaction wheels or control moment gyros. Inevitably these wheels have slight imbalance that cause vibrations or jitter of the spacecraft, e.g., making the laser beam wiggle. This presentation reports on a series of theoretical and experimental results, testing various intelligent or adaptive control methods, which aim to learn how to cancel the jitter at the location of the fine pointing instrument. For example, learn how to wiggle the output mirror of the laser so that the laser does not wiggle while the mirror is on a spacecraft that is vibrating.

Biography

Richard W Longman is Professor of Mechanical and Civil Engineering, Columbia University, and was Distinguished Romberg Guest Professor, 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. He is Fellow of AAS and AIAA. He served the AAS as Vice President - Publications, VP Technical, First Vice President, and Member Board of Directors. His doctorate is from the University of California, San Diego, under Prof. R. E. Roberson who did the first study of satellite attitude control in 1951, 6 years before the first satellite. He has co-authored approximately 450 publications.

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