Introduction to Space Systems Dynamics Laboratory

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During the past decades space activities have had a dramatic influence on human life and culture by

- increasing our scientific knowledge of the solar system and the universe,
- revolutionizing communication and imaging systems, and
- providing the technical foundations to human existence and the utilization of resources in space.

These capabilities and activities have been made possible by the development and application of engineering expertise. At present, the engineering community is called upon to further enhance the existing technologies in order to develop reliable and high-performance space capabilities that are less demanding in cost.

The roles of the Space Systems Dynamics Laboratory are education and research of space engineering with focus on astrodynamics and satellite system design. Additional topics of research are the investigation of the orbital environment with particular interest to space debris and deep space exploration.

1. Small Satellite Design

SSDL performs unique 'hands-on' satellite design activities through the design and construction of the QSAT small satellite. This work involves mission analysis, spacecraft system design as well as subsystem design problems. QSAT is planned to be launched on a H-IIA rocket in 2009 or later and intend to perform scientific investigations that will lead to a better understanding of the Earth's magnetic field and aurora.

2. Spacecraft Guidance and Control

SSDL is building up capabilities and expertise in the area of satellite attitude determination and control. One important motivation comes from the specific QSAT design requirements, which need to be met by low-cost but reliable concepts. Other important and interesting practical applications originate from the guidance and control of deep space probes during their cruise and encounter phases when it comes close to its intended target planet, comet, or asteroid.

3. Orbital Environment Simulation and Protection

To deal with the orbital debris issues that threats safety in space, orbital debris evolutionary models have been built by incorporation of laws of astrodynamics and empirical assumptions. The assumptions have been augmented and verified by a series of laboratory satellite impact tests. This work not only deals the world-wide effort to predict orbital environment but it also provides a novel tool to identify effective procedures of orbital environment protection.