

Proposal for a new course

Course title: Spacecraft Attitudinal Dynamics & Control

Course no.: SPA XYZ

Proposer : Ishan Sharma, Arun Misra

Department: Space, Planetary & Astronomical Sciences and Engineering (SPASE)

Credits: 9 (3-0-0-0)

Pre-requisite: First year mechanics and calculus.

Course description and contents: This course discusses the attitudinal dynamics and stability of a spacecraft. The lecture distribution is given below in terms of 42 lectures of 50 minutes each.

1. **Rotational kinematics:** Reference frames; Rotations; Angular displacement parameters; Angular velocity; Alternative parameters – 3 lectures
2. **Attitude motion equations:** Rigid body equations; Examples – 3 lectures
3. **Attitude dynamics of a rigid body:** Motion equations; Torque free motion of axisymmetric and general rigid body; Stability; Effect of torque; Examples of spacecraft torques; Effect of internal dissipation – 12 lectures
4. **Multispin vehicles:** Directional stability; Internal dissipation — 3 lectures
5. **Spacecraft in orbit:** Gravitational stabilization; Spin stabilization; Dual-spin stabilization — 9 lectures
6. **Attitude hardware and modeling:** Sun sensors; Horizon sensors; Magnetometers; Star sensors; Gyroscopes; Momentum & reaction wheels; Magnetic coils; Gas jets — 6 lectures
7. **Attitude control:** Feedback control; Momentum & reaction wheels; Nutation & libration damping; Gyroscope; Thrust vectoring — 3 lectures
8. **Attitude maneuver control:** Spin-axis & spin-plane magnetic coil; Gas jet; Inertial guidance; Attitude acquisition — 3 lectures

Textbooks and references:

1. Hughes, PC. 2004. Spacecraft Attitude Dynamics, Dover.
2. Wertz, JR 1978. Spacecraft Attitude Determination And Control. Kluwer
3. Wie, B. 2008. Space Vehicle Dynamics and Control (AIAA Education Series)
4. Kaplan, MH. 1976. Modern Spacecraft Dynamics and Control. Wiley, NY.

Signature of the Proposer

This course is APPROVED/NOT APPROVED Convener, DPGC

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