Mechanical, Materials and Aerospace Department
Satellite Attitude Dynamics and Control
EAS 4400

Designation        Elective

2002-03 Catalog Description:
Kinematics and dynamics of rigid and multibody spacecraft rotational motion. Attitude control
with momentum exchange actuators and thrusters.

Pre-requisite(s):
EML 3312C

Textbook(s):

Reference(s): Control of spacecraft and aircraft, Bryson, A.E., Princeton University Press
(ISBN 0-691-08782-2)

Course Objectives:
1. Identify the principal characteristics, applications, advantages and disadvantages of various
attitude control concepts.
2. Understand the geometry of space mission analysis and how it applies to the attitude
determination and control subsystem requirements and design.
3. Understand the description of attitude kinematics using reference frames, rotation matrices,
Euler parameters, and Euler angles.
4. Understand the equations of motion for rigid bodies, including modeling assumptions,
angular momentum, Euler’s equations, moments of inertia, and the solutions for an
axisymmetric body.
5. Know the environmental forces and moments affecting satellite motion. Apply basic
dynamics analysis to the attitude dynamics of spin, dual-spin, three-axis, and gravity
gradient stabilized satellites, including the effects of energy dissipation.
6. Understand and apply basic relations for gyroscopic instruments and for reaction wheel
(RW) and control moment gyro (CMG) control systems. Understand the similarities and
differences between RW and dual-spin systems.
7. Understand the application of basic linear control theory to basic attitude control problems.

Class Schedule:
Number of sessions per week 3
Duration of each session 50 min.

Laboratory Schedule:
Number of sessions per week None
Duration of each session

Contribution of course to meeting the Professional Component:
- Math & Science Topics 1
- Engineering Topics 2
- General Education Topics 0
Relationship of the course to Program Outcomes:

- Homework, exams (3a)
- Term project (Design) of Spacecraft (3b)
- Design Project (3c)
- Design Project by teams (3d)
- Examinations and discussions (3e)
- Classroom discussions (3f)
- Design project presentation (3g)
- Homework, exams (3h)
- Classroom discussions (3i)
- Classroom discussions (3j)
- Homework, exams, discuss past examples (3k)

Grading (+, - system will be used):

- 2 Tests ** 60 %
- Class participation 20 %, presentation & class attendance (1 absence = -2 pts, 2 abs = -4 pts, 3 or more abs. = -8 pts after calculating the class total)
- Homework 20 %
- Final Test** 30 % (Comprehensive, it may be combined with the 2nd exam)
- Team project 10 % (bonus, only for students absented from class less than 4) ** Best 2 out of 3 exams

Instructor Office Hours:

W 11:00pm - 12:00pm, F 1:30pm - 2:30pm, or to be arranged.
(407) 658-5598, 823-2536, Rm. # 308 Engr I Bldg.
cham@mail.ucf.edu

Teaching Assistant:  Sudhir Kora
407-737-2582
skora@mail.ucf.edu, korasudhir@hotmail.com

Class Website: http://pegasus.cc.ucf.edu/~cham/eas4400.htm

Prepared by:  Dr. Chan H. Ham  Date:  08/25/03