MAE180A Spacecraft Guidance, Navigation, and Mission Design

MW 2:00
Center 216

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Office hours: Tues 4:00–5:00,
or contact me to set up a time.

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Tuesday 12-1, 305 EBU 2.
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Text: Strongly recommended: Purchase something along the lines of Bate/Meu-
ller/White, “Fundamentals of Astrodynamics” (rather old, but very inexpen-
sive).
Alternatively, a more modern book is Prussing/Conway, “Orbital Mechan-
ics”.

Objective: The course will be directed toward providing the students with abilities
which will enable them to contribute fully to any future project which might
arise involving the mission planning and control of a satellite or more general
spacecraft.

Grading: TENTATIVELY, the final course grade will be calculated as follows:
  Homework: 15%
  Quiz 1: 24%
  Quiz 2: 24%
  Extended Homework/Presentation: 10%
  Final Test: 27%
  Class Participation Modifier: ±3%
  (Typically, the overwhelming majority have 0% modification.)

  Homework will be due at the beginning of class. Homework handed in
  later that day (but by 5:30PM) will still be accepted but with a loss of 10%
  of that homework grade. Homework cannot be handed in later than 5:30PM
  on the due date. Not all homework problems will be graded.

  Depending on the time available and course-support levels, the home-
  work assignments may include one extended assignment (or group project),
  which would require more effort than the standard homework problems.

  The tentative plan is to have two quizzes and a final test.
Content: The equations of Orbital Mechanics will be discussed with an emphasis on the propagation of spacecraft trajectories. First, the differential equations which describe the motion will be given. This will be followed by the standard solution for the case of two spherical bodies and a discussion of numerical methods appropriate for more complex situations. The relevant coordinate systems and transformations between them will be covered. We will also discuss orbital maneuvers at this point.

Secondly, the determination of the position and velocity of spacecraft from typical data types will be covered. This is the navigation problem. The main method for such determination is the extended Kalman Filter. A discussion of elementary probabilistic concepts may be necessary prior to presentation of the filter equations.

Other possible topics include trajectory optimization, spacecraft and sensor attitude control, and flight through planetary atmospheres.

On reserve: A.E. Roy – Orbital Motion
Bate, Mueller, and White – Fundamentals of Astrodynamics
Prussing and Conway – Orbital Mechanics
Bryson and Ho – Applied Optimal Control