

AOE 5234 ORBITAL MECHANICS

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Text: Fundamentals of Astrodynamics and Applications

David A. Vallado

McGraw Hill, New York, 1997

or

An Introduction to the Mathematics and Methods of Astrodynamics

Richard H. Battin

AIAA 1987 (2nd edition 2000?)

Grading:	Two Tests	2
	Homework, etc	1
	Final	<u>2</u>
	Total	5

Ground Rules : Students are encouraged to discuss homework together. However, the final effort MUST BE YOUR OWN. Assignments will be given on a quasi-weekly basis.

OUTLINE

1. REVIEW OF METHODS IN ANALYTICAL MECHANICS
 - LAGRANGES EQUATIONS OF MOTION
 - WORK-ENERGY RELATIONS
 - CONSERVATIVE FORCES AND POTENTIALS

2. TWO - BODY PROBLEM
 - CONSTANTS OF MOTION AND DEFINITION OF SOLUTION
 - ORBIT EQUATIONS
 - TIME RELATIONS
 - ALTERNATE FORMULATIONS
 - EXPANSIONS

3. PERTURBATION METHODS IN SPACE MECHANICS
 - APPROXIMATE EFFECTS OF VARIOUS DISTURBANCES ON NEAR CIRCULAR ORBITS
 - VARIATION OF PARAMETERS
 - STRAIGHT FORWARD PERTURBATION SOLUTIONS
 - LAGRANGE'S PLANETARY EQUATIONS
 - GAUSS' FORM OF LAGRANGE'S PLANETARY EQUATIONS

4. ADVANCED TOPICS
 - APPLICATIONS
 - MANY BODY PROBLEM
 - CONSTANTS OF MOTION
 - THREE BODY PROBLEM AND KNOWN SOLUTIONS
 - RESTRICTED THREE BODY PROBLEM
 - STABILITY CONSIDERATIONS

REFERENCES

1. Bate Mueller & White; *Fundamentals of Astrodynamics*, Dover Publications Inc. 1971
Excellent “first” book.
2. Geyling & Westerman, *Introduction to Orbital Mechanics*, Addison Wesley, 1971
Excellent book.
3. Wiesel, *Spaceflight Dynamics*, McGraw Hill, 1989
Has additional material regarding launch vehicles and satellites.
4. Hale, *Introduction to Space Flight*, Prentice Hall, 1994
A “by the numbers” book, lacks rigor.
5. Chobotov, *Orbital Mechanics*, AIAA, 1996
This book is ok for an AIAA book - lots of topics, probably better as a second book.
6. Danby, *Fundamentals of Celestial Mechanics*, Macmillan, 1962, 1989
Good stuff in here.
7. Kaplan, *Modern Spacecraft Dynamics and Control*, John Wiley & Sons, 1976
Has additional material about satellite control.
8. Brower & Ckemence, *Methods of Celestial Mechanics*, Academic Press, 1961
A classic text discussing classic methods.
9. Roy, *Foundations of Astrodynamics*, Macmillan, 1965
One of the early texts with applications.
10. Roy, *Orbital Motion*, Adam Hilger Ltd, 1978
More than a revision of the first book, also more classic material.
11. McCuskey, *Introduction to Celestial Mechanics*, Addison Wesley, 1963
A thin concise first level book, has a nice treatment of three body problem.
12. Szebehely, *Adventures in Celestial Mechanics*, U. of Texas Press, 1989
Fun reading, tries to get the reader excited about celestial mechanics.
13. Szebehely, *Theory of Orbits (The three body problem)*, Academic Press, 1967
Another classic book which discusses regularization methods as well as classic orbital mechanics.
14. Prussing and Conway, *Orbital Mechanics*, Oxford University Press, 1993
Classic approach with modern notation.

15. Smart, *Celestial Mechanics*, Longmans, Green and Co. Ltd., 1960
Rigorous classical material, nice expansion discussions