AME 524 – Fall 2017

Advanced Engineering Dynamics

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Office: VHE 418, TBD

Class: OHE 100B, Th 7:00-9:40 PM

Course Description

This course addresses the fundamentals and techniques for the formulation and solution of problems in mechanics that lie within the realm of classical mechanics. The course aims to provide a strong working knowledge of both the important results of analytical mechanics and their application to engineering problems through numerical analysis. Topics covered in the course include:

Basic concepts: equations of motion, Galilean transformation, generalized coordinates, constraints, virtual work.
Lagrangian mechanics: principle of least action, Lagrange's equation, ignorable coordinates, conservation laws.
Constrained motion: Gauss' principle of least constraint, fundamental equation of constrained motion, generalized inverses.
Rigid body motion: Euler angles, quaternions, inertia tensor, angular momentum, motion in a non-inertial frame of reference.
Kepler's problem: Newtonian gravitation for distributed bodies, N-body problem.
Hamiltonian mechanics: Legendre's transformation, Hamilton's equations, Hamilton-Jacobi equations, Poisson brackets, Noether's theorem.

Required Text

- Analytical Dynamics: A New Approach (1996) by F.E. Udwadia and R.E. Kalaba.

References

- A Treatise on Analytical Dynamics (1981) by L.A. Pars.
- Applied Mechanics Dynamics, Second Edition (1980) by G.W. Housner and D.E. Hudson.
- Mechanics, Third Edition: Volume 1 (1976) by L.D. Landau and E.M. Lifshitz.

Grading

Homework – 30%
Midterm – 30% (7^{th} week)
Final – 40%