DMS6021 - Dynamics and Control of Mechanical Systems

Jimma University, Spring 2021

Date	Topics
Day 1 (10/05)	1. Review of the basics of mechanics.
Day 2 (11/05)	2. Kinematics of rigid bodies - coordinate transformation, angular velocity vector, description of velocity and acceleration in relatively moving frames.
Day 3 (12/05)	3. Euler angles, Review of methods of momentum and angular momentum of system of particles, inertia tensor of rigid body.
Day 4 (13/05)	4. Dynamics of rigid bodies - Euler's equation, application to motion of symmetric tops and gyroscopes and problems of system of bodies.
Day 5 (14/05)	5. Kinetic energy of a rigid body, virtual displacement and classification of constraints. 6. D' Alembert's principle.
Day 6 (15/05)	Tutorial 1: Introduction to use of MATLAB in matrix manipulation
Day 7 (17/05)	7. Introduction to generalized coordinates, derivation of Lagrange's equation from D' Alembert's principle.
Day 8 (18/05)	8. Small oscillations, matrix formulation, Eigen value problem and numerical solutions.
Day 9 (19/05)	9. Modelling mechanical systems, computer generation and solution of equations of motion.
Day 10 (20/05)	10. Introduction to complex analytic functions, Laplace and Fourier transform.
Day 11 (21/05)	11. PID controllers, Phase lag and Phase lead compensation. 12. Analysis of Control systems in state space, pole placement.
Day 12 (22/05)	Exercise/Tutorial 2: Computer simulation of control systems using MATLAB
Note	Lecture time: 08:30 – 11:30 (02:30 – 05:30 local time) and/or 04:00 – 06:30 (10:00 – 12:30 local time)

Course Evaluation

- Mid semester examination (two tests) 30%
- One project report without presentation 20%
- Final examination 50%

References

1. T.R. Kane, David A. Levinson, Dynamics: Theory and Applications, McGraw-Hill.
2. Donald T. Greenwood, Advanced Dynamics -– Cambridge University Press
3. Ferdinand P. Beer et al., Vector Mechanics for Engineers, Dynamics, -McGraw-Hill Sci
4. Lennart Ljun and Torkel Glac, Modelling of dynamic systems, P T R Prentice Hall International.
5. Katsuhiko Ogata, Modern Control Engineering, 5th ed., Prentice Hall
6. Other relevant sources