Advanced Dynamics

2018/2019

Online Academic Course

TU Delft

Course Description

Dynamics is a branch of mechanics that deals with physical phenomena of a body or bodies in motion and how forces can be related to motion. Advanced dynamics is about modelling complex dynamical systems and assessing how their equations of motions can be derived. Building on the principles developed by Lagrange and Hamilton, in this course you will learn to apply advanced dynamics principles to real-world projects, using a systematic matrical formulation to assess how complex systems behave with regards to the kinetic and potential energy involved. There is no specific application area; however the course will include examples of aircraft, helicopters, satellites, wind turbines and robots. The knowledge gained throughout this course can be applied to any field of engineering which requires an understanding of analytical mechanics.

To learn from online you are advised to keep a personal learning journal for this course, capturing the pieces of this jigsaw that make up the complex picture of dynamic systems. Herein you can reflect on things that you learnt. Your reflection needs to reveal the what, the how and the why of the theory, and may involve breaking down denial barriers. It is only from these reflections that you will integrate new knowledge and skills. Please use the discussion board to share some of your reflections in this learning process. Hope you will enjoy the course.

Learning Objectives

By the end of this course you will be able to:

1. Be aware of that complex systems can be simple if they are treated systematically.
2. Have the ability to develop equations of motions and do simulations based on analytical models.
3. Understand difficult concepts such as Coriolis force and gyroscopic effects.
4. Develop an understanding of what is the difference between Newtonian and Lagrangian dynamics.
5. Connect advanced dynamics to relativity and quantum theories.

All learning objectives will be provided in an academic environment which will stimulate you to engage in discussions and reflections on advanced dynamics.

Study materials

1. AE4-314 Lecture Notes, Delft University of Technology, 2002 - will be provided via the Electronic Learning Environment.
2. "Advanced Engineering Dynamics", Jerry Ginsberg, 1998 - examples which are treated in classical way
3. "Engineering Dynamics", Jerry Ginsberg, 2007 - modern vector oriented treatment of classical dynamics and its application to engineering problems
4. "Analytical mechanics", Josef Török, 2000 - classical treatise on analytical mechanics
5. "Classical Mechanics", Gregory Douglas, 2006
6. "Variational Principles of Mechanics", Cornelius Lanczos, 1970 - analytical dynamics with insight on the history of dynamics

Course Structure and Dates

Week 1	Introduction to course. Vectors and Systems of references
Learning Activities	Watch the videos and read the slides. Present yourself. Discuss on the discussion board.
Assignments	Present yourself, Participate in the discussion board, Work on Assignment 1
Assessment:	Present yourself: 2% of Final Grade, Assignment 1: 25% of Final Grade
Deadline Assignment	Present yourself: End week 1, Assignment1: End week 3 DEADLINE PRESENT YOURSELF FG= Final Grade

Week 2	Principles of Coriolis and Centrifugal forces
Learning Activities	Watch the videos, read the slides. Read Discussion board
Assignments	Participate in the discussion board, Work on Question2 of Assignment1
Assessment	Assignment1: 25% of Final Grade
Deadline Assignment	Assignment1: End week 3

Week 3	Angular velocity and Angular momentum
Learning Activities	Watch the videos, read the slides. Read Optional reading.
Assignments	Participate in the discussion board, Finish Assignment 1.
Assessment	Assignment 1: 25% of the Final Grade Assignment 1: End week 4
Deadline Assignment	DEADLINE ASSIGNMENT 1

Week 4	Kinetic energy
Learning Activities	Watch the videos, read the slides. Read Discussion board.
Assignments	Participate in the discussion board, Work on Assignment 2.
Assessment	Assignment 2: 25% of Final Grade Assignment 2: End week 5
Deadline Assignment	

Week 5	Principle of Hamilton
Learning Activities	Watch the videos, read the slides. Read discussion board.
Assignment	Participate in the discussion board, Work on Assignment 2
Assessment	Assignment 2: 25% of the Final Grade Assignment 2: End week 5
Deadline Assignments	DEADLINE ASSIGNMENT 2

Week 6	Lagrange equations
Learning Activities	Watch the videos, read the slides. Read Discussion board.
Assignment	Participate in the discussion board, Work on Assignment 3 Assignment 3: 40% of Final Grade
Assessment	Assignment 3: End week 9
Deadline Assignment	

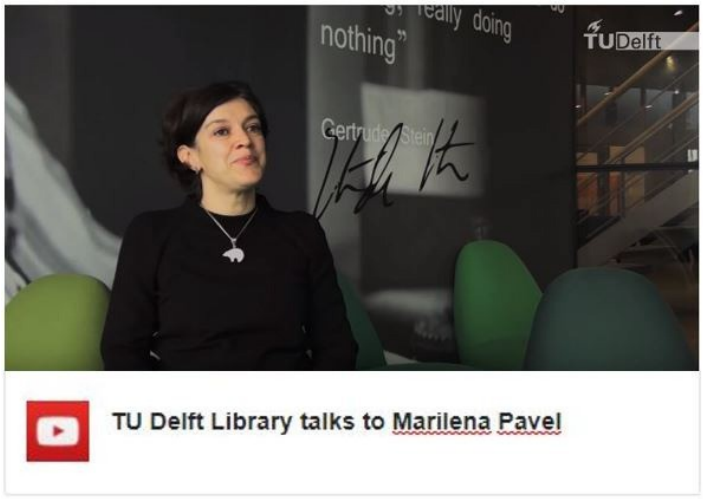
Week 7	Gyroscopic principles
Learning Activities	Watch the videos, read the slides. Read discussion board. Optional reading.
Assignments	Participate in the discussion,Work on Assignment 3
Assessment	Assignment 3: 40% of the Final Grade
Deadline Assignments	Assignment 3: End week 9

Week 8,9	WORK on Assignment 3 to be handed in at the End of Week 9 or Earlier

Contacts

Dr. M. D. Pavel (Marilena), Associate Professor at the Department of Control & Simulation, Faculty of Aerospace Engineering, at Delft University of Technology.

You can find out more about the lecturer of this course by following:



Online Learning Support - Email: onlinelearningsupport@tudelft.nl
For questions about registration, accounts and other questions not related to the content of the course.