

MECH 469/529

Modelling of Dynamic Systems

3 Credits, First Term, 2016/17

Tuesdays and Thursdays in Room CEME 1204

5:00 to 6:30pm

Course Web Site: www.sites.mech.ubc.ca/~ial (Courses → MECH 469/529)

Instructor

Dr. Clarence W. de Silva, Professor

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Office Hours: Wednesdays 2:00 to 3:00 pm

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Office Hours: Thursdays 3:00 to 4:00 p.m. in ICICS 081

Prerequisites

This graduate course is suitable for both Master's and Doctoral students. There are no specific prerequisites. But, students who have already taken introductory courses in circuit analysis, dynamics, fluid mechanics, and thermodynamics (or energy conversion) will be at an advantage.

Objectives

The course deals with the methodology of understanding and modeling a physical engineering system. The primary emphasis will be on the engineering problem of modeling rather than the applied mathematics of response analysis (and simulation) once a model is available, even though the latter aspects will also be covered in the course.

The students will learn to understand and model mechanical, thermal, fluid and electrical systems in a systematic and unified/integrated manner. For example, identification of lumped elements such as sources, capacitors, inductors, and resistors in different types of physical systems will be studied. Analogies among the four main types of systems (mechanical, thermal, fluid and electrical) will be presented in terms of these basic lumped elements and in terms of the system variables. Concepts of through and across variables, and flow and effort variables will be introduced. Multi-domain (or mixed) systems which consist of two or more of the basic system types will be considered as well.

Tools of modeling and model-representation such as linear graphs and block diagrams will be discussed. Important considerations of input, output, causality, and system order will be examined. Thevenin and Norton equivalent circuits and their application in mechanical systems using linear graphs will be studied. A brief overview of response analysis will be given.

Textbook

De Silva, C.W., *Modeling and Control of Engineering Systems*, Taylor & Francis/CRC Press, Boca Raton, FL, 2009.

MECH 529 COURSE LAYOUT

Week	Starts	Topic	Read
1	Sept 06	Introduction	Chapter 1
2	Sept 13	Model Types, Analogies	Chapter 2
3	Sept 20	Electrical Systems	Chapter 2
4	Sept 27	Fluid Systems	Chapter 2
5	Oct 04	Thermal Systems	Chapter 2
6	Oct 11	State-space Models	Chapter 2
7	Oct 18	Model Linearization	Chapter 3
8	Oct 25	Linear Graphs	Chapter 4
9	Nov 01	State Models from Linear Graphs	Chapter 4
	Tuesday, Nov 01:	Intermediate Exam (in class)	
10	Nov 08	Transfer Function Models	Chapter 5
11	Nov 15	Thevenin/Norton Equivalent Circuits and Linear Graph Reduction	Chapter 5
12	Nov 22	Simulation Block Diagrams	Chapter 5
13	Nov 29	Response Analysis and Simulation Advanced Topics; Modeling Applications	Chapter 6
	Thursday, Dec 01:	Final Take-home Question Paper Given Out in Class	
	Thursday, Dec 08:	Final Take-home Exam Due by 4:00 pm at TA's office	

Examinations:

Nov 01, 2016 (Tuesday): Intermediate Examination (In Class)

Dec 01, 2016 (Thursday): Final Take-home Exam given out in class

Dec 08, 2016 (Thursday): Final Take-home Exam Due in TA's Office, by 4:00 p.m.

Grade Composition

Intermediate examination	40%
Attendance	10%
Final take-home examination	<u>50%</u>
Total	100%