Definitive Module Document (DMD)

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Module Code:3AAD0007

Title of Module
Full Title: Control Systems
Short Title: Control Systems

MODULE

3AAD0007 (A 05/6)

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Version: 1

Credit Points: 15

Level / ECTS Level: 3

First Offered: 1/9/2004 00-00-00

6. Home Department:
AAD

7. Departments(s) contributing to teaching:

9. Module Aims:

* further develop their ability to analyse the performance of control systems

* design controllers to modify the performance of control systems.

10a. Learning Outcomes: Knowledge and Understanding:

* identify whether a system satisfies a desired performance specification

10b. Learning Outcomes: Skills and Attributes:

* evaluate the dynamic performance of a control system

* design a controller to improve the performance of a control system.

* use a computer to simulate the performance of a control system

11. Module Content
11a Module Content:
1. Root Locus Methods - Revision of rules for drawing root locus plots and design of controllers

2. Open Loop Frequency Response - Open Loop testing, Nyquist diagrams, Bode Plots. System Identification using asymptotic approximations.

3. Closed Loop Frequency Response - Nichols Chart. Nyquist Stability Criterion, Closed Loop frequency response performance specification. Controller design.

4. Non-Linear Systems - Sources of non-linearity in systems, stability of non-linear systems, Describing Functions.

5. Digital Root Locus - Difference Equations and z transforms. Stability and the z plane. A/D and D/A converters and the Zero Order Hold model, adaptation of Root Locus drawing rules. Controller design.

Students are expected to make use of Matlab and the Control Systems Laboratory to support their studies.

11b. Further details on how the learning outcomes of the module will be achieved:
Lectures

1. Revision of Root Locus Methods - Drawing rules, dominant loci.

2. Controller Design using Root Locus - Lead and Lag controllers

3. Nyquist Plots - Frequency Response Testing, Gain and Phase Shift, Nyquist Plots of Complex Systems

4. Bode Plots - Gain vs Frequency, Phase vs frequency, TF Ident

5. Closed loop Frequency Response - Nyquist Stability Criterion, Nichols Chart and Closed Loop Performance

6. Controller Design using Frequency Response Methods

7. Modelling Non-Linear Systems - input vs output curves, describing functions

8. Stability of Non-linear Systems - Limit cycle prediction using Nyquist and Nichols

9. Introduction to Digital Control - Z Transforms & Digital Time Response

10. A/D and D/A Converters and the digital equivalent transfer function- Zero Order Hold model, Gp(z) using Z transform tables

11. Digital Root Locus - Z plane, drawing digital root locus plots, first order digital controllers

Tutorials

Students will receive a tutorial each week to support the lectures above. Some of these tutorials will be assessed.

Practicals

Students will be introduced to the use of Matlab to design controllers and simulate control system performance so that they can use Matlab either within the faculty or the LRC on an open access basis.

Students will be introduced to practical equipment in the Control Systems laboratory which they can then use on a open access basis.

12. Language of Delivery:
English

13. Language of Assessment:
English

14. Assessment Details (Academic):
Coursework: 40

Exam: 60

Other:

Typically, assessment will consist of-

- One 3-hour end-of-course examination (60%) - learning outcome(s) assessed (a), (b) and (c)

- One 2-hour computer based phase tests (20%) - learning outcome(s) assessed (a), (b), (c) and (d)

- One laboratory based assignment (10%) - learning outcome(s) assessed (a), (b), (c) and (d)

- Several minor tutorial based assignments (10%) - learning outcome(s) assessed (a), (b) and ©

Assessment Notes:
Passes in both (i) coursework and (ii) overall performance are required

15. Locations(s):
UH HATFIELD

16. Pre and Co-Requisite:
Pre-Requisite

Co-Req

Prohibited

17. Subject Board of Examiner/s:
AERO/CIVIL/MECH ENG L2/3

18. Comments