Approval : 11th Senate meeting

Course Description

Course Name: Robust Control Systems

Course code: EE-514

Credits: 3-0-0-3 (Lectures-Assignments-Practical-Total)

Prerequisites: UG Control theory

Intended for: UG/MS/PhD

Elective/Core: Elective

Semester: Odd/Even

Course Outline: The course is divided in five modules. In the first module, mathematical preliminaries, such as matrix norms, signal and system norms, singular value decomposition and LMIs will be introduced. Second and third module cover the analysis of linear time invariant systems and the interconnection of plant and controller. Fourth module introduces the concept of uncertainty and robust stability/performance of a system. In the last module students will learn several controller synthesis procedures.

Modules:

1. *Mathematical Preliminaries:* 7 lectures

Vector and matrix norms, Signal and system norms, Singular value decomposition, LMIs.

2. *System Analysis:* 7 lectures

System representation, sensitivity and complementary sensitivity function, concept of poles and zeros, pole and zero directions, performance limitations.

3. *Feedback interconnection & Stability theory:* 5 lectures

Well-posedness, Internal stability of feedback system, Nyquist plot, Small gain theorem.

4. *Uncertainty and robustness*: 12 lectures

Uncertainty representation (*structured/parametric and unstructured*), robust stability and robust performance, *Kharitonov's theorem, linear fractional transformation (LFT),* applications of robust control in physical systems.

5. *Controller Synthesis*: 7 lectures

Stabilizing controllers, H_∞ control, μ Synthesis.

Textbooks

1. S. Skogestad and I. Postlethwaite, Multivariable Feedback Control: Analysis and Design, John Wiley & Sons, 2001. (second edition).
2. S.P. Bhattacharyya, H. Chapellat, L.H. Keel, "Robust Control: The parametric approach", Prentice Hall (1995).
3. K. Zhou, J.C. Doyle, K. Glover, "Robust and Optimal Control", Prentice Hall (1996).
4. O. H. Bosgra, H. Kwakernaak, G. Meinsma, "Design Methods for Control Systems", Notes for a course of the Dutch Institute of Systems and Control, Winter term 2007–2008.
5. S. Boyd, L. E. Ghaoui, "Linear Matrix Inequalities in System and Control Theory" , SIAM, 1994.