Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

HIAST

Course Specification Document

Title	Nonlinear Control

Credits	3.5 ECTS

Aims	This course aims to provide the student with knowledge specific to nonlinear systems and enable him to use the related tools to describe a nonlinear system and control its behavior by several methods.

Intended learning outcomes

On successful completion of this course, the student will be able to:

- Describe non-linear systems in phase plane and the frequency domain in different ways and identify the control methods based on them.
- Understand the concept of stability according to Lyapunov and the control methods based on it.
- Identify some non-linear control methods such as sliding mode control - Feedback Linearization.
- Apply the theoretical concepts in the field of control to real systems.
- Apply mathematical models using the computer to obtain operational models.

Syllabus

- **Introduction to nonlinear systems:** Comparison between nonlinear and linear behavior, nonlinear phenomena.
- **Phase plane portrait:** Phase plane trajectories, analysis of nonlinear systems in the phase plane, local behavior of nonlinear systems.
- **Limit cycles:** Poincaré's theory, Bendixon's theory
- **Describing function:** The first harmonic method, the analytical method.
- **Lyapunov stability theories:** Linearization, Lyapunov direct theory (local and global stability), Invariant sets theories - LaSalle.
- **Sliding mode control.**
- **Feedback linearization:** Input-state linearization, Input-output linearization**.**
- **Backstepping.**