# STABILITY THEORY OF DYNAMIC SYSTEMS
## METU EE555 - FALL 2021

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**Scope:** This course aims to cover some of the standard methods used in the stability analysis of nonlinear systems.

**Prerequisite:** Some knowledge of Linear Systems (EE502) is assumed.

**Textbook:** H.K. Khalil. *Nonlinear Systems (Third Edition).* Prentice Hall, 2002.

**Tentative course outline:**

I. *Basic concepts*

- Examples of nonlinear models

- Second-order systems: phase plane, multiple equilibria, limit cycles

- Fundamental properties of differential equations: existence/uniqueness, finite escape time

II. *Lyapunov Theory*

- Lyapunov functions

- Linearization

- Invariance principle

- Converse theorems

III. *Various design and analysis tools*

- Backstepping

- Input-to-state stability

- $\mathcal{L}$-stability

- Small-gain theorem

- Passivity

IV. *Discrete-time systems*

- Lyapunov Theory

- Deadbeat observer