NONLINEAR SYSTEMS AND CONTROL

Outline

Topic	No. of lectures	Textbook Section
Introduction	2	1.1-1.2 & 3.1-3.2
Second-order systems	4	2.1-2.5 & 2.7
Stability of equilibrium points	7	4.1-4.5, 4.7, 8.2 & 9.1
Passivity	4	6.1-6.5 & 7.1
Input-state and Input-output stability	4	4.8, 9.2, 4.9, 5.1-5.4 & 6.4
Special nonlinear forms	3	13.2-13.3 +
Stabilization	7	12.1-12.2, 13.4.1, 14.3, 14.4+
Robust stabilization	3	14.1.1-14.1.2, 14.2 & 14.3
Tracking	2	13.4.2, 14.1.3 +
Observers	4	14.5 +
Regulation via integral control	1	12.3-12.4, 14.1.4, 14.5.3 +

+ indicates additional material

Lecture Plan

Lecture #	General Topic	Lecture Topic
1	Introduction	Nonlinear models
2		Examples
3	2nd-order systems	Phase portraits
4		Multiple equilibria
5		Limit cycles
6		Bifurcation
7	Stability of EPs	Basics & linearization
8		Lyapunov's method
9		Lyapunov's method
10		Invariance principle
11		Exp stability & ROA
12		Converse thm's & TVS
13		Perturbed systems
14	Passivity	Memoryless&S models
15		PRTF & Lyapunov
16		Feedback systems
17		Circle & Popov Criteria
18	IS & IO stability	Ultimate bound & ISS
19		Input-output stability
20		L stability of S models
21		L2 gain& mall gain thm
22	Nonlinear forms	Normal form
23		Controller form
24		Observer, output & SF
25	Stabilization	Concepts&linearization
26		Feedback linearization
27		Cascaded systems
28		Backstepping

29		Passivity-based control
30		Control Lyapunov fn
31		Output feedback
32	Robust stabilization	Sliding-mode control
33		Sliding-mode control
34		Lyapunov redesign&BS
35	Tracking	Feedback lineariz/SMC
36		Point-to-point
37	Observers	Linearization & EKF
38		Exact Observers
39		High-gain observers
40		High-gain observers
41	Integral control	Linearization & SMC