

# TTK4150 Nonlinear Control Systems

## Schedule of lectures

Fall 2003

**Text:** H.K. Khalil: *Nonlinear Systems*, 3. edition, Prentice Hall, 2002.

Week	Dates	Topics	Litterature	Comments
33	15.08	Preliminaries	Appendix A	Important mathematical results that will be used throughout the course.
		Introduction	Chapter 1	Nonlinear phenomena - how nonlinear systems are different from linear systems, and we therefore need new tools for analysis and control design.
34	22.08	Fundamental properties	Chapter 3: 3.1 and 3.4	Existence and uniqueness of solutions are no matter of course for nonlinear system equations, and have to be established to validate the system model.  The comparison principle is a useful mathematical result that will be used in the course.
		Phase plane analysis	Chapter 2: 2.1-2.6	<b>Nonlinear analysis (and control design)</b> - start.
35	29.08	Lyapunov stability	Chapter 4: 4.1-4.6	
36	05.09		4.7:	
37	12.09		Th. 4.15	
38	19.09		Cor. 4.3	
			Chapter 8: 8.2-8.3	
39	26.09	Input-Output stability	Chapter 4: 4.9	
			Chapter 5: 5.1-5.4	
40		No lectures		
41				MIDTERM EXAM
42	17.10	Passivity	Chapter 6	

43	24.10	The Describing function method	Chapter 7: 7.2	
44	31.10	Nonlinear feedback control design	Chapter 12	<b>Nonlinear control design:</b> The analysis tools found the basis for the control design, (as for instance seen when studying the describing function method). In the last part of the course this is formalized in a number of design methods, including <ul style="list-style-type: none"> <li>• Gain-scheduling</li> <li>• Feedback linearization</li> <li>• Cascaded control</li> <li>• Lyapunov redesign</li> <li>• Backstepping</li> <li>• Passivity-based control</li> </ul>
45	07.11		Chapter 13: 13.1-13.2	
46	14.11		13.4	
47	21.11		Chapter 14: 14.2-14.4	
48	28.11			