VILLANOVA UNIVERSITY
COLEGE OF ENGINEERING

EGR 8309: Adv. Topics in Dynamics and Control - Applied Nonlinear Control, Fall 2010

Instructor: Dr. Hashem Ashrafiuon
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Office Hours: Mon. & Wed. 9:30 am – 11:30 am & Wed. 1:30 pm – 2:30 pm

Textbook: Hassan K. Khalil. Nonlinear Systems. 2001, 3rd edition, Prentice Hall
ISBN: 0-13-067389-7

Prerequisites: ME 7000 or equivalent and EGR 8301 or equivalent

Grading: The grading structure is only tentative and subject to change
Two exams (50%); assigned projects and homework (25%);
Independent semester long project (25%)

Objective: To learn the fundamental properties, perform stability analysis, and design nonlinear controllers for nonlinear systems

Topics:

1- Examples of nonlinear systems; multiple equilibrium points; limit cycles; bifurcation; fundamental properties of nonlinear systems

2- Lyapunov stability; Input-Output stability; Small Gain Theorem

3- Passivity as a tool for analysis of nonlinear systems

4- Advanced stability analysis: Center manifold theorem, region of attraction, Invariance-Like theorems

5- Linearization-based control approaches

6- Feedback Linearization control approach

7- Sliding Mode Control

8- Lyapunov Redesign approach

9- Backstepping control design

10- Passivity-based control design