

AE 6270 APPLIED NONLINEAR DYNAMICS

LIST OF TOPICS

1. Introduction	2 hours
Discrete and continuous systems	
Autonomous and non-autonomous systems	
Phase portraits and flows	
Attracting sets	
Concepts of stability	
2. Nonlinear Vibrations	14 hours
Problems with straight-forward expansions	
Method of averaging	
Method of multiple scales	
Cubic and quadratic nonlinearities in free and forced systems	
Introduction to non-linear vibration absorber	
Distributed parameter systems and energy transfer between modes	
3. Bifurcation of Continuous Systems	5 hours
Local bifurcations	
Normal forms	
Lyapunov-Schmidt method	
Multiple scales method	
Co-dimensions	
4. Periodic and Quasiperiodic Systems	7 hours
Floquet theory	
Poincare maps	
Symmetry breaking bifurcations	
Cycle-fold bifurcations	
Flip bifurcations	
Flip bifurcations	
Second-order Poincare maps	
Analytical construction methods	
5. Chaos	10 hours
Continuous time systems	
Period-doubling scenario	
Intermittency mechanisms	
Quasi-periodic routes	
Melnikov theory	
Dimension calculations	
Lyapunov exponents	
Thermodynamics of chaotic motion	
6. Control of Chaos and Bifurcations	6 hours
OGY method	
Feedback linearization method	
7. Quiz, Exam	1 hour

Total

45 hours

Text: *Applied Nonlinear System* by A.H. Nayfeh

Ref: *Nonlinear Vibrations* by D. Mook and A.H. Nayfeh