جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Geometry of Nonlinear Systems - ME 320

Division	Physical Science and Engineering Division
Course Number	ME 320
Course Title	Geometry of Nonlinear Systems
Academic Semester	Spring
Academic Year	2018/2019
Semester Start Date	01/27/2019
Semester End Date	05/23/2019
Class Schedule (Days & Time)	02:30 PM - 04:00 PM | Sun Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Mohammad Ibrahim Younis	Mohammad.Younis@KAUST.EDU.SA	+966128080597	3219, 4, Al-Jazri (bldg. 4)	**Time and Date:** Th, T, 2:30 -4:00 PM.

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	-To introduce you to the world of nonlinear dynamics and nonlinear oscillations. -To gain understanding for basic characteristics and phenomena of nonlinear dynamics and oscillations. -To learn analytical and numerical techniques to tackle nonlinear problems.
Course Description from Program Guide	
Goals and Objectives	-To introduce you to the world of nonlinear dynamics and nonlinear oscillations. -To gain understanding for basic characteristics and phenomena of nonlinear dynamics and oscillations. -To learn analytical and numerical techniques to tackle nonlinear problems.
Required Knowledge	General Knowledge of differntial equations and linear vibrations.
Reference Texts	1-Nayfeh, A. H. and Balachandran, B., “Applied Nonlinear Dynamics,” Wiley, New York, 1995. 2-Nayfeh, A. H. and Mook, D., “Nonlinear Oscillations,” Wiley, New York, 1979.
Method of evaluation	**30.00**% - Exam 2 **40.00**% - Homework /Assignments **30.00**% - Exam 1
Nature of the assignments	Most of the HWs will require the use of symbolic software such as Mathematica and Matlab
Course Policies	-All homeworks must be submitted in class on the due date. -Late HWs will be penalized 20% for each day of delay.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Sun 01/27/2019	-Introduction to Nonlinear Oscillations
1	Wed 01/30/2019	Definitions, historical background, phase space, phase portraits, linear oscillators.
2	Sun 02/03/2019	- Effect of constant forces on systems with quadratic and cubic nonlinearities.
2	Wed 02/06/2019	Primary resonance
3	Sun 02/10/2019	secondary resonances
3	Wed 02/13/2019	sub harmonic and super harmonic resonances of systems with quadratic and cubic nonlinearities.
4	Sun 02/17/2019	Parametric resonance.
4	Wed 02/20/2019	-Self excited systems
5	Sun 02/24/2019	-The method of multiple scales.
5	Wed 02/27/2019	-The method of multiple scales.
6	Sun 03/03/2019	-The method of multiple scales.
6	Wed 03/06/2019	Internal resonance
7	Sun 03/10/2019	Fixed points
7	Wed 03/13/2019	stability concepts
8	Sun 03/17/2019	linearization and stability analysis
8	Wed 03/20/2019	bifurcation types.
9	Sun 03/24/2019	Spring Break
9	Wed 03/27/2019	Spring Break
10	Sun 03/31/2019	**Equilibrium solutions (maps)**
10	Wed 04/03/2019	Fixed points, stability concepts, linearization and stability analysis, bifurcation types
11	Sun 04/07/2019	Fixed points, stability concepts, linearization and stability analysis, bifurcation types
11	Wed 04/10/2019	**Periodic solutions**
12	Sun 04/14/2019	Floquet theory
12	Wed 04/17/2019	bifurcations
13	Sun 04/21/2019	shooting technique
13	Wed 04/24/2019	Poincare section
14	Sun 04/28/2019	introduction to quasi-periodic solutions.
14	Wed 05/01/2019	**Topics in nonlinear oscillations**
15	Sun 05/05/2019	**Chaos**
15	Wed 05/08/2019	Definitions, classifications,
16	Sun 05/12/2019	identification methods, routes to chaos
16	Wed 05/15/2019	the escape from a potential well phenomenon, tangling.
17	Sun 05/19/2019	Final Exam Week
17	Wed 05/22/2019	Final Exam Week

Note

The instructor reserves the right to make changes to this syllabus as necessary.