Figure: Poincaré sections for the Duffing Oscillator; \( \alpha=1.0, \beta=-1.0, \delta=0.2, \gamma=0.3, \text{ and } \omega=1.0. \)

Notes and Resources...
are linked from the schedule.

Catalog description

Prerequisites
1. Math 337, Elementary Differential Equations
2. Math 541, Numerical Analysis and Computing

Computational Resources:
You must have access to a somewhat modern version of Matlab, or some other computational environment that you are comfortable using. Class accounts for the labs will be available. You can also use SDSU’s Rohan Sun Enterprise system or another capable system. [How to open a ROHAN account].

Students with Disabilities:
If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619)594-6473. To avoid any delay, please contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and cannot be provided until an accommodation letter from Student Disability Services is received by the Professor.

Optional Texts and Reading Materials:

Course Outline (as of 1/19/2015):

Classification of ODEs; Euler's Method, Runge-Kutta Methods, Linear Multistep Methods, Predictor-Corrector Methods, Adaptive Methods, Variable Order Methods, Hybrid Methods, Shooting Methods; Stability Regions, Stiff ODEs & Boundary Value Problems; Multiscale Phenomena; Lotka-Volterra Models, The Lorenz System, The Van der Pol Equation.

Professor

Peter Blomgren
blomgren DOT peter AT gmail DOT com
Class hours: TuTh 11:00a – 12:15p, GMCS-325
Office hours: Tu 9:00a – 10:30a & Th 2:00p – 3:30p, GMCS-587, and by appointment.

Grades are based on

50% Homework
50% Project

Project Details

Details TBA.

Expectations and Policies (non-exhaustive)

● When you come to class:
  ○ Please be on time.
  ○ Please pay attention.
  ● Don't sleep, read the newspaper, check email, etc...
  ○ Please turn off mobile phones.
  ○ Please be courteous to other students and the instructor!
  ○ Abide by university statutes, and all applicable local, state, and federal laws.
  ● Turn in assignments on time. (The instructor reserves the right not to accept late assignments.)
  ● The instructor will make special arrangements for students with documented learning disabilities and will try to make accommodations for other unforeseen circumstances, e.g. illness, personal/family crises, etc. in a way that is fair to all students enrolled in the class. Please contact the instructor EARLY regarding special circumstances.
  ● Students are expected and encouraged to ask questions in class!
  ● Students are expected and encouraged to make use of office hours! If you cannot make it to the scheduled office hours: contact the instructor to schedule an appointment!
  ● Missed midterm exams: Don't miss exams! The instructor reserves the right to schedule make-up exams, make such exams oral presentation, and/or base the grade solely on other work (including the final exam).
  ● Missed final exam: Don't miss the final! Contact the instructor ASAP or a grade of incomplete or F will be assigned.
  ● Academic honesty: submit your own work — but feel free to discuss homework with other students in the class!
    ○ The following Honesty Pledge must be included in all programs you submit (as part of homework and/or projects):
      I, (your name), pledge that this program is completely my own work, and that I did not take, borrow or steal code from any other person, and that I did not allow any other person to use, have, borrow or steal portions of my code. I understand that if I violate this honesty pledge, I am subject to disciplinary action pursuant to the appropriate sections of the San Diego State University Policies.
    ○ Larger reports must contain the following text
      I, (your name), pledge that this report is completely my own work, and that I did not take, borrow or steal any portions from any other person. Any and all references I used are clearly cited in the text. I understand that if I violate this honesty pledge, I am subject to disciplinary action pursuant to the appropriate sections of the San Diego State University Policies. Your signature

Work missing the honesty pledge will not be graded!
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<thead>
<tr>
<th>Week #</th>
<th>Tuesday</th>
<th>Thursday</th>
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</table>
| **1** | **Jan-20-2015**  
Martin Luther King, Jr. Day (January 20th) | **Jan-22-2015**  
First Meeting  
ODEs: Classification, Examples, Euler's Method (first look)  
[Notes #1]  
**Movies:**  
◦ [unforced]  
◦ [forced]  
◦ [geocentric] |
| **2** | **Jan-27-2015**  
Calculus and Math 541 Review | **Jan-29-2015**  
Euler's Method, a second look |
| **3** | **Feb-03-2015**  
Stability Regions  
Runge-Kutta Methods | **Feb-05-2015**  
Runge-Kutta Methods, Modern Approach  
**HW#1 Due (Friday)** |
| **4** | **Feb-10-2015**  
Application of RK Methods to Lotka-Volterra Models | **Feb-12-2015**  
Linear Multistep Methods, I  
Linear Multistep Methods, II |
| **5** | **Feb-17-2015**  
Example: The Lorenz System | **Feb-19-2015**  
Predictor-Corrector Methods  
**HW#2 Due (Friday)** |
| **6** | **Feb-24-2015**  
Stiff ODEs -- Multiscale Phenomena | **Feb-26-2015**  
Runge-Kutta Methods for Stiff ODEs |
| **7** | **Mar-03-2015**  
Linear Multistep Methods for Stiff Systems | **Mar-05-2015**  
Example: The Van der Pol Equation  
**HW#3 Due (Friday)** |
| **8** | **Mar-10-2015**  
Example: Adaptive RKF45 Solver | **Mar-12-2015**  
Example: Variable Order LMM Schemes  
Projects!!! [past] |
| **9** | **Mar-17-2015**  
Hybrid Methods | **Mar-19-2015**  
General Linear Methods  
**HW#4 Due (Friday)** |
| **10** | **Mar-24-2015**  
Boundary Value Problems – Introduction | **Mar-26-2015**  
BVP: The Shooting Method, ctd. |
| **11** | **Mar-31-2015**  
Spring Break  
Cesar Chavez Day (March 31st) | **Apr-02-2015**  
Spring Break |
| **12** | **Apr-07-2015**  
Finite Difference Methods | **Apr-09-2015**  
Higher Order Equations (FD)  
**HW#5 Due (Friday)** |
| **12** | **Apr-14-2015**  
Nonlinear Equations | **Apr-16-2015**  
Spectral Methods  
Reference: Spectral Methods in MATLAB |
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<td>The Finite Element Method – Introduction; Basic Theory</td>
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<td>The Finite Element Method – Continued; Numerics</td>
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<td>FEM: Numerics, Triangulation, Element Stiffness Matrix</td>
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<td>FEM: Hilbert Spaces --- $L_2(D)$, $H^1(D)$, and $H^1_0(D)$</td>
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<td>FEM: Geometric Interpretation</td>
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Homework and Projects will be assigned.

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