Applied Asymptotic Analysis, Fall 2014
APMA 1930M
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http://www.dam.brown.edu/people/jgemmer/APMA-1930M.html
Office: 182 George Street, Room 328, **Phone:** (401) 863-2114
Office Hours: Tuesday 1:00-3:00, Thursday 1:00-3:00 (and by appointment)
Class Meeting Times: TTh: 9:00-10:20
Class Location: Rockefeller Library A9

Prerequisites: Advanced calculus, linear algebra, differential equations. Students should be comfortable with proofs at the level of advanced calculus and be comfortable with computer programming of numerical algorithms (MATLAB code usually).

Textbooks: *Introduction to Perturbation Methods*, Mark H. Holmes, 2013.

Supplementary Textbooks:
Applied Asymptotic Analysis, Peter D. Miller, 2006
Perturbation Methods, E.J. Hinch, 1991

Course Description: An introduction to the asymptotic analysis of nonlinear systems. Topics covered will include: asymptotic solutions to transcendental equations, order symbols, regular and singular perturbations, boundary layer theory, multiscale and averaging methods, homogenization and asymptotic expansions of integrals. The course will be equal parts theory and applications with the applications drawn from physical systems.

Course Rationale: Many problems in applied mathematics and physics are nonlinear and are intractable to solve using elementary methods. In this course we will systematically develop techniques for obtaining quantitative information from nonlinear systems by exploiting small scale parameters. Along the way, we will discuss many applications including nonlinear waves, coupled oscillators, nonlinear optics, fluid dynamics and pattern formation.

Class Delivery: The course material will be delivered through lectures. Evaluation of the students understanding of the material will be assessed through written homework assignments, take home exams and a semester project.

Course Policies:
✦ **Grading:**
Your grade will be based on:
- Weekly Homework: 25%
- Class Works: 5%
- Two take home exams: 20% each
- Term paper proposal: 5%
- Term paper: 20%
- Final Presentation: 5%

✦ **Homework:**
Homework will be assigned most weeks on Wednesday and will be due Friday of the following week. The assigned homework problems will be posted on my website.

✦ **Class Works:**
Throughout the course there will be several "class works". These consist of structured group assignments that should be completed during class time. These assignments will generally be exploratory allowing students to learn a new concept through a "hands on" approach.

✦ **Exams:**
There will be two exams in the course. Both exams will be take home and will be due at a specified date. There is to absolutely no collaboration on these exams.

✦ **Term Paper Project:**
A significant portion of the student's progress towards completion of the course goals will be evaluated through a term paper project. The project should apply techniques from this course to a problem within the student's field of interest. The term paper topic can consist of something from the current literature or a classical problem. The text book has a number of The project consists of a proposal, term paper and a final presentation. The proposal should consist of a rough sketch of the project. The proposal is **due in class October 16**. The term paper should be written as an expository article with all mathematical details fully written out and is **due by December 15**. The dates of the final presentations will be decided later.

Important Dates:

1. October 16: Exam 1.
2. October 23: Term paper proposal due.
3. November 20: Exam 2.
4. December 15: Term paper due.
5. Final Presentations: TBD