APMA 2200 – Nonlinear Dynamical Systems

Spring semester, 2018

Instructor:
Anastasios Matzavinos

Office:
Room 325, 182 George Street

Class meeting times:
Tu & Th 2:30 pm – 3:50 pm, 170 Hope Street 108

Office hours:
Tu & Th 4:10pm – 5:00pm
(or by appointment)

Class web page:
https://canvas.brown.edu/courses/1075322

Announcements and other information about the class will be posted regularly on the class web page.

Course description:

The focus of this course is bifurcation theory and averaging methods for nonlinear dynamical systems, including infinite-dimensional dynamical systems and partial differential equations. Topics covered include the Lyapunov-Schmidt reduction, Leray-Schauder degree-theoretic methods, some of the local and global bifurcation results due to Crandall, Rabinowitz, Krasnoselski, and Dancer, the Hopf bifurcation, center manifolds and normal forms, and geometric approaches to averaging theory. Several topics from functional analysis, such as Fredholm operators and spectral theory for bounded operators, will be covered in class to facilitate the understanding of the above material.

Useful references:

Although there is no required text, the following, among others, may be useful in parts of the course:

- Hansjörg Kielhöfer, *Bifurcation theory: An introduction with applications to partial differential equations,* 2nd edition, Springer.
- Shui-Nee Chow and Jack Hale, *Methods of bifurcation theory,* Springer.
- Antonio Ambrosetti and Andrea Malchiodi, *Nonlinear analysis and semilinear elliptic problems,* Cambridge University Press.
- Jan Sanders, Ferdinand Verhulst, and James Murdock, *Averaging methods in nonlinear dynamical systems,* 2nd edition, Springer.

The textbook by Hansjörg Kielhöfer, in particular, contains most of the material covered in this course.

Grading policy:

The final grade will be based on a combination of homework assignments and in-class presentations. Discussion of homework assignments with other students is encouraged but what you hand in should be your own work. There will be no final exam.

Accommodations and other considerations:

Brown University is committed to full inclusion of all students. Please inform me early in the term if you have a disability or other conditions that might require accommodations or modification of any of these course procedures. You may speak with me after class or during office hours. For more information, please contact Student and Employee Accessibility Services at 401-863-9588 or SEAS@brown.edu.

Students in need of short-term academic advice or support can contact one of the deans in the Dean of the College office.