King Fahd University of Petroleum and Minerals
Department of Mathematics & Statistics

MATH 695 Reading and Research I

Title: Exponential attractors

Semester I, 2014-2015 (141)

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Objectives: This course is designed to prepare PhD students to take up research in the area of infinite-dimensional dynamical systems with applications to nonlinear PDEs.

Course Description:

This course will introduce students to the theory of exponential attractors for dissipative partial differential equations in infinite dimension. The course will also cover the continuity of exponential attractors with respect to small perturbations (including singular ones). The course will cover the global attractor, Lipschitz and Holder continuity, squeezing property, the fractal dimension, exponential attractors, upper and lower semicontinuity. As typical examples, exponential attractors for reaction-diffusion equations and Navier-Stokes equations will be studied. Continuity properties of exponential attractors for singularly perturbed damped wave equations will also be analyzed.

Credit: 3 credit hours

Text Book: A. Eden, C. Foias, B.Nicolaenko and R. Temam, Exponential attractors for dissipative evolution equations, Masson, Paris, 1994.

Additional Reading:

1. A construction of a robust family of exponential attractors, Proc. Amer. Math. Soc. 134 (2006), pp. 117–127, by S. Gatti, M. Grasselli, A. Miranville and V. Pata.
2. Slightly compressible 2D Navier-Stokes equations revisited, Advances in Mathematical Sciences and Applications 20 (1) (2010), 77-89, by A. Bonfoh.
3. Dynamics of Hodgkin-Huxley systems revisited, Applicable Analysis 89 (8) (2010), 1251-1269, by A. Bonfoh.
4. Long time behavior of a singular perturbation of the viscous Cahn-Hilliard-Gurtin equation, Mathematical Methods in the Applied Sciences 31 (2008), 695-734, by A. Bonfoh, M. Grasselli, A. Miranville.

Week	Chapter	Material
1	2	Construction of exponential attractors for maps
2	3	Exponential attractors for dissipative evolution equations of first order
3 -6	5	Applications
7-8	6	Exponential attractors for second order evolution equations with damping and applications

9-15	Case Study	Robustness of exponential attractors with respect to singular perturbations. Papers 1 through 4 mentioned in "Additional reading"

Grading:

The distribution of grade is as follows:

Class test I, II	30%
Class work (homework assignments)	30%
Final Exam	40%
Total	100%