LTCC COURSE IN DYNAMICAL FUNCTIONAL EQUATIONS AND THEIR APPLICATIONS

- Course Title: Dynamical Functional Equations and their Applications
- Core Audience: First year graduate students and beyond
- Course Format: Extended (10 hours at 2 hours per week)
- Keywords: functional equation, iteration, nonlinear dynamics, renormalization, linearization, Schröder and Abel equations
- Lectures. Five two-hour lectures on the following topics:
  (1) Overview of elementary concepts from dynamical systems: iteration, fixed points and periodic orbits, stability, conjugacy and semi-conjugacy, fundamental domains. We shall also give a brief overview the most important classical examples of dynamical systems.
  (2) Dynamical Functional equations: introduction and examples.
  (3) One dimensional Schröder's equation: properties, solution, applications. Higher dimensional examples: linearization of maps and differential equations around fixed/equilibrium points
  (4) Abel's equation, properties, solution, and applications. The one-dimensional linear functional equation, including applications to log-periodic power laws in the natural sciences and finance.
  (5) Linear functional equations, definition, relationship to iterated function systems, spectral and other properties of associated operators. Examples and applications.
  (6) Nonlinear functional equations, examples including the Feigenbaum functional equation, solution methods, application to critical phenomena in dynamical systems.
- Format
  (1) Four exercise sheets
  (2) Electronic notes (to be made available after end of course, if not earlier)
- Prerequisites: Standard undergraduate courses in real and complex analysis and ordinary differential equations. Some knowledge of nonlinear dynamical systems would be an advantage but is not necessary.
- References
  - Jaroslav Smítal, On Functions and Functional Equations, Adam Hilger, 1988, ISBN 0852744188. (This is a nice introduction to functional equations.)
  - Marek Kuczma, Bogdan Choczewski, Roman Ger, Iterative Functional Equations Issue 32 of Encyclopedia of Mathematics and its Applications, ISSN 0953-4806, Cambridge University Press, 1990, ISBN 0521355613, 9780521355612

(This is a comprehensive book on functional equations, suitable for those who wish to take their studies further.)

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