This course analyzes various models of growth and cycles, including those of Samuelson, Hicks, Kalecki, Kaldor, Goodwin, as well as more recent models emerging from the nonlinear dynamics literature. We will begin with an overview of the empirical evidence, and then proceed to a review of the mathematics of linear and nonlinear difference and differential equations. These tools will then be used to analyze various cycle and growth models (including ones with limit cycles and chaotic dynamics). Instruction will also be provided in the use of simulation software. Students will be required to write a paper for course credit, and will be encouraged to develop and present their own applications, either singly or as part of a group.

Empirical Patterns and Basic Theoretical Approaches

I. Survey of the Business Cycle Literature (3 sessions)


II. Basic Mathematics and Models (6 sessions)

1. First-Order Linear Difference and Differential Equations

Gandolfo, G., Economic Dynamics: Methods and Models, 2nd Ed., Amsterdam, North-Holland, 1985, Ch. 1-4 and Ch. 11-13. Economic examples
OUTLINE AND SYLLABUS

2. Second-Order Linear Difference and Differential Equations
   Gandolfo, Ch. 5-6; Ch. 14-15.
   Economic examples

3. Lab Session on Computer Modeling: using the "TUTSIM"

4. Systems of Linear Difference and Differential Equations: 2x2
   Gondolfo, Ch. 9-10; Ch. 18-19
   Hirsch, M.W. and S. Smale, Differential Equations, Dynamical Systems, and Linear Algebra, New
   Economic examples

5. Non-Linear Systems of Differential Equations: 2x2
   Gandolfo, Ch. 21 (general treatment of stability), Ch. 24 (Nonlinear dynamics)
   Economic example: Kaldor's cycle model
     Research Program
   * Gandolfo, Ch. 25-27 (complex dynamics)

III. Statistics and Econometrics of Trends and Cycles. (1 session)

Monetary Economics, 10, 1982: 132-162.
45, no. 3, April 1977, 737-744
Brock, W., "Nonlinear and Complex Dynamics in Economics and Finance", in P.W. Anderson, K. J.
Arrow and D. Pines (eds.) The Economy as an Evolving Complex System, Addison-Wesley
IV. Class Presentations of Growth and Cycle Models (4 Sessions)

1. Kaleckian Models
Bhaduri, A. Macroeconomics, New York, M.E. Sharpe, Chs. 6-7.

Mathematics: Gandolfo, Ch. 27; Gabish, G., et al, Ch. 3.3

2. Goodwin Model
Goodwin, R. "Economic Evolution and Evolution of Economics, University of Siena, (mimeo on reserve).

Mathematics: Gandolfo, Ch. 24 (sections 5.3 & 7.4).

3. Tobin Model (3X3)

Mathematics: Gandolfo, Ch. 18

4. Minsky Model

Mathematics: Gandolfo, Ch. 18 & Ch. 24.

5. Liquidity and Debt Cycle Models
OUTLINE AND SYLLABUS

[Starred (*) Readings are Optional]

Foley, D., (1983), "Say's Law in Marx and Keynes", unpublished ms. (on reserve)

Mathematics: Gandolfo, Ch. 24.

6. Models with Time Delays

Kalecki, M. Cf. the section on Kalecki (particularly the article by J. Steindl).

Mathematics: Gandolfo, Ch. 27