

Instructor: RONALD WENDNER

Office hours: TUE 10:00 – 11:00 a.m.

E-mail: ronald.wendner@uni-graz.at ♦ <https://homepage.uni-graz.at/de/ronald.wendner/>

320.562 ADVANCED APPLIED MATHEMATICS (VU, 3h)

MON 17:00 – 19:00, SR 15.4C (F-4)

The course starts March 4, 2024.

1. COURSE DESCRIPTION

This course focuses on discrete dynamical systems, which are essential in economics due to their widespread use. Examples include overlapping-generations models, growth models, and environmental models, all of which rely on stock-flow relationships. The course provides a systematic exploration of dynamical systems, covering one-dimensional to multi-dimensional systems, as well as linear and non-linear systems. Towards the end, we delve into the literature on bifurcations and chaos.

2. ESSENTIAL PREREQUISITES

This course is self-contained. We use mathematical tools as typically used in economics master programs (linear algebra, optimization). In the classes on applications, we employ overlapping generations models. As regards bifurcations and chaos, we will use some bits of measure theory.

3. LITERATURE

REQUIRED READING

- Galor, O. (2007), Discrete Dynamical Systems, Berlin, Heidelberg, New York: Springer-Verlag.
- My presentation + additional materials (notes, created during the course):
My website → Teaching → Advanced Applied Mathematics
- Journal articles (applications part), announced during the course

FURTHER REFERENCES

- Medio, A., M. Lines (2001), Nonlinear Dynamics. A Primer, Cambridge: Cambridge University Press.
- Sorger, G. (2015), Dynamic Economic Analysis. Deterministic Models in Discrete Time, Cambridge: Cambridge University Press.

- Sydsaeter, K., P. Hammond, A. Strom, A. Carvajal (2016⁵), Essential Mathematics for Economic Analysis, Harlow: Pearson Education.

4. TENTATIVE SCHEDULE OF LECTURES & PROGRAM

Week 1	Organizational issues; dimensions of dynamic analyses; a simple OLG model
Week 2	One-dimensional, first-order systems
Week 3	Multi-dimensional, first-order, linear systems: solution 1
Week 4	Multi-dimensional, first-order, linear systems: solution 2
Week 5	Multi-dimensional, first-order, linear systems: characterization 1
Week 6	Midterm exam
Week 9	Multi-dimensional, first-order, nonlinear systems
Week 10	Higher-order and non-autonomous systems
Week 11	Applications 1 (Planar, linear systems)
Week 11	Applications 2 (OLG economies)
Week 12	Applications 3 (Environmental economics; bifurcations)
Week 13	Project presentation
Week 14	Final exam

Midterm Exam: 22 April 2024

Project Presentation: 17 June 2024

Final Exam: 24 June 2024

5. GRADING

The grading is based on: a midterm exam (35%); a final exam (35%); in-class participation and a project presentation (30%).

My grading is based on your percentage achievement. The percentage grades correspond to the letter grades as follows.

86-100 %: sehr gut (A), 73-85 %: gut (B), 60-72 %: befriedigend (C), 50-59 %: genügend (D), 1-49 % nicht genügend (F).

6. FURTHER RESOURCES

Office hours. My office hours are for clarifying any questions regarding the materials we discuss you might have.

Moodle. Moodle supports our course. Please see your Moodle for further resources.

My Uni Graz Website. Please find auxiliary materials (transparencies, notes) at: <https://homepage.uni-graz.at/de/ronald.wendner/teaching/>