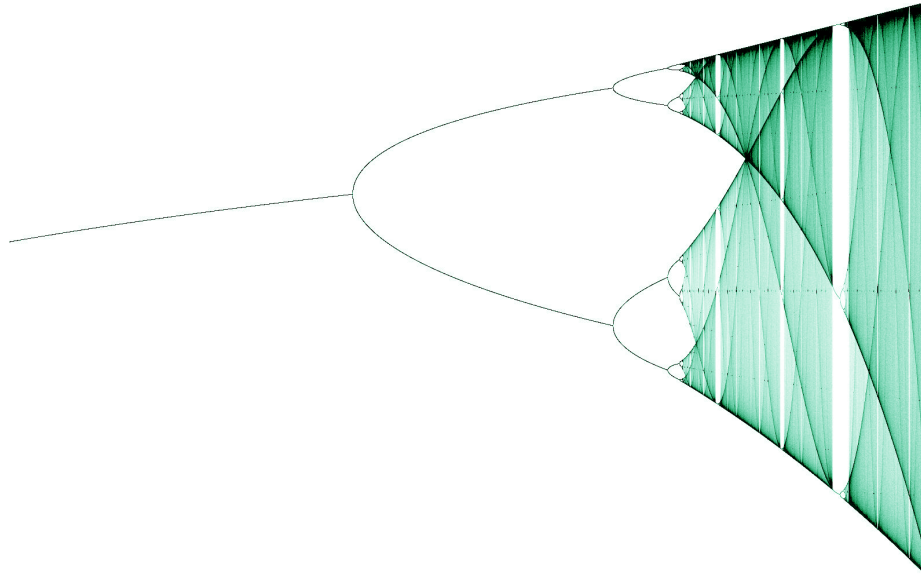


Course Announcement - Spring 2024  
ME 463/663 : Nonlinear Dynamics and Chaos



Bifurcation diagram of the logistic map (modified from Wikipedia)

Though linear techniques form the powerful and often elegant scaffolding of mathematical physics, and thus the bulk of a classical scientific and engineering education, pretty much **everything in this universe is nonlinear**.

We will cover many aspects of nonlinear science, integrable and chaotic, conservative and dissipative, differentiable and discrete, dynamic and static. The course will unfold through numerous examples, using the dynamics of forced, damped, nonlinear oscillators as a reference point, and with an emphasis on geometric and visual representations of the physics. Along the way, we will learn some techniques for solving and approximating differential equations, and for probing chaotic behavior in discrete experimental data.

The concepts we will cover are quite universal. They can be, and have been, applied to the behavior of aircraft panels, marine risers, wind turbines, rubberlike or biological materials, machine elements, electronic circuits, toys, playground swings, celestial mechanics, chemical reactions, bridges, capsizing ships, fusion reactors, shallow water waves, insect communications, patterns in vegetation observed in aerial photographs, spots and stripes on organisms, buckled elastic systems, billiards, and the transition to turbulence in fluids, to name a few possibilities.

**Anonymous comments from previous students:**

“this was probably the most interesting and thoughtful engineering class I have taken”

“this course has motivated my change of major”

“I never once wanted to skip”

“a hidden gem”

**Prerequisites:** (MATH 283 AND ME 310) OR (MATH 285 AND PHYS 351)

**Time:** Monday/Wednesday 16:00-17:15

**Book:** None required, but students often like to buy the “Nonlinear dynamics and chaos” book by Strogatz (the two editions are nearly identical). Note, however, that this book omits much of the material covered by this course. I also recommend the “Nonlinear dynamics and chaos” book by Thompson and Stewart. Please feel free to contact me for further book suggestions and details.

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