COURSE DESCRIPTION FOR 18.994

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Dynamical systems are ubiquitous in nature and play a fundamental role in our description of various time-dependent processes. They come in a differentiable form (e.g. differential equations), discrete form (e.g. difference equations), they can be linear or (more commonly) nonlinear. They are often useful in various other fields of mathematics (such as the partial differential equations or differential geometry) as well as in biology, mechanics, weather prediction etc.

This seminar will focus on some of the central ideas in the theory of dynamical systems such as the stability/instability of equilibria, homoclinic and heteroclinic orbits, invariant manifolds and their construction, and the theory of chaos. The guiding text will be the book by Hirsch, Smale, & Devaney on dynamical systems [1] which offers a breadth of interesting topics along the above lines.

Prerequisites: 18.100A or the equivalent thereof, basic sequence in calculus, differential equations, and linear algebra.

References

[1] Hirsch, M., Smale, S., Devaney, R. Differential Equations, Dynamical Systems & An Introuction to Chaos. Second Edition, Elsevier (2004)