

University of California, Berkeley

From the Selected Works of David D Nolte

Fall 2019

Preface to the 2nd Edition.pdf

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Available at: <https://works.bepress.com/ddnolte/31/>

Preface to the 2nd Edition

Introduction to Modern Dynamics: Chaos, Networks, Space and Time (2015) is part of an emerging effort in physics education to update the undergraduate physics curriculum. Conventional junior-level mechanics courses have overlooked many modern dynamics topics that physics majors will use in their careers: nonlinearity, chaos, network theory, econophysics, game theory, neural nets, geodesic geometry, among others. These are the topics at the forefront of physics that drive high-tech businesses and start-ups where more than half of physicists are employed. The first edition of *Introduction to Modern Dynamics* contributed to this effort by introducing these topics in a coherent program that emphasized common geometric properties across a wide range of dynamical systems.

The second edition of *Introduction to Modern Dynamics* continues that trend by expanding chapters to including additional material and topics. It rearranges several of the introductory chapters for improved logical flow and expands them to add new subject matter. The second edition also has additional homework problems.

New or expanded topics in the second edition include

- Lagrangian applications
- Lagrange's undetermined multipliers
- Action-angle variables and conserved quantities
- The virial theorem
- Non-autonomous flows
- A new chapter on Hamiltonian chaos
- Rational resonances
- Synchronization of chaos
- Diffusion and epidemics on networks
- Replicator dynamics
- Game theory
- An extensively expanded chapter on economic dynamics

The goal of the second edition of *Introduction to Modern Dynamics* is to strengthen the sections on conventional topics (that students need for the GRE physics subject test), making it an ideal textbook for broader adoption at the junior level, while continuing the program of updating topics and approaches that are relevant for the roles that physicists will play in the 21st century.

The historical development of the ideas behind modern dynamics is described in *Galileo Unbound: A Path Across Life, the Universe and Everything*, by D. D. Nolte, published by Oxford University Press (2018).