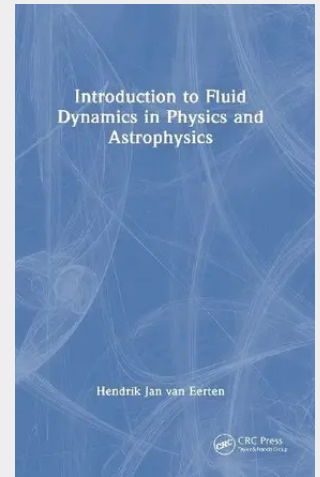


Introduction to Fluid Dynamics in Physics and Astrophysics

This textbook provides an accessible and self-contained introduction to the physics behind fluid dynamics; exploring the laws of nature describing three out of four fundamental states of matter (liquids, gases, and plasmas). Based on years of teaching of fluid dynamics theory and computation at advanced undergraduate level, it provides readers with the tools to understand and model fluid dynamical systems across a wide range of applications, from dense liquids to dilute space plasmas. The book covers the principles of fluid dynamics for an audience without prior exposure to fluid dynamics specifically. Discussion of relevant vector algebra, thermodynamics and electromagnetism is included, to ensure that the book is accessible both to readers experienced in these topics and readers starting from a basic understanding. Example applications are drawn both from astrophysics and physics, touching upon topical research such as relativistic blast waves from neutron star mergers and the implications of plasma nature of the atmosphere for present and future radio observatories. These are contrasted and complemented with examples from general physics (e.g. contrasting the incompressible nature of water with the dilute interstellar medium). It is an ideal textbook for advanced undergraduates studying the topic and will provide a solid foundation for further (postgraduate) studies into fluid dynamics in physics or astrophysics. Key Features: - Introduction to fluid dynamics pitched at advanced undergraduate level, accessible to students who are still learning relevant mathematical techniques - Includes over 60 exercises and selected worked solutions, in addition to timely examples and easily accessible numerical demonstrations written in C and python for readers to experiment with (https://github.com/hveerten/code_fluid_dynamics_book) - Up-to-date selection of topics including fluid dynamics in special relativity and computational fluid dynamics, written by an expert in the field. The book covers all that is needed to independently write a finite-volume solver for Euler's equations and/or reproduce the provided Python and C software - Covers a wide range of applications in astrophysics, including first-order Fermi acceleration in shocks, accretion discs, self-similarity in cosmic explosions and interstellar turbulence

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