

Book Review

Paxton, Anthony T. *Fundamentals of Transport Phenomena*. Cambridge, UK: Cambridge University Press, 2025. Hardback. xv + 294 pages. Dimensions: 244 × 170 mm. Weight: 0.67 kg. ISBN-13: 9781009562829. eBook ISBN: 9781009562843. <https://doi.org/10.1017/9781009562843>.

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This book presents a unified treatment of momentum, mass, and heat transfer grounded in continuum mechanics and thermodynamics. It emphasizes the interconnection between Newton's law of viscosity, Fourier's law of heat conduction, and Fick's law of diffusion, framed through conservation laws and the Reynolds transport theorem, providing theoretical development and derivation over guided learning. The text is concise, targeting advanced undergraduate or early graduate students in physics, engineering, and materials science. The text is solidly academic; it consistently derives results from first principles and avoids heuristic shortcuts. Notably,

- Navier–Stokes equations are derived multiple times from different viewpoints;
- diffusion is extended beyond standard engineering treatments into atomistic and rate-theory perspectives;
- mathematical level assumes comfort with vector and tensor calculus, making it suitable as a modern text for physics or engineering audience. The inclusion of solid mechanics and tensorial stress descriptions provides depth rarely seen in introductory texts;

- examples such as vortices, boundary layers, and diffusion processes are treated with physical clarity, providing valuable physical insight;
- applications span fluids, materials science, and thermodynamics, particularly valuable for modern research contexts.

With its intended scopes and audience, the book is short on turbulence coverage, no discussion of numerical methods or CFD, brief coverage of radiation, and no discussion on non-Newtonian/rheological complex fluids. It is intellectually elegant and conceptually coherent, and is a refined, theoretically grounded treatment. Compared with Bird, Stewart & Lightfoot [1], it is more mathematically rigorous, but less comprehensive in applications and correlations, and compared with White [2], it is more unified and theoretically motivated, but less extensive in fluid mechanics. It is a strong academic textbook with a distinctive perspective, and best suited for advanced undergraduates or graduate students in Physics/Engineering, or Materials Science seeking theoretical depth.

References

- [1] R. B. Bird, W. E. Stewart, and E. N. Lightfoot, *Transport Phenomena*, United Kingdom, Wiley, 2009.
- [2] F. White, *Fluid Mechanics*, New York, McGraw-Hill Education, 2015.

Nhan Phan-Thien (Phan Thiện Nhân): Founding Deputy Editor (2026-) *Transport Phenomena* and *Open Transport* (de Gruyter-Brill, Berlin), Deputy Editor (2023-25), Associate Editor (2016-23) *Physics of Fluids*, (AIPP, New York).