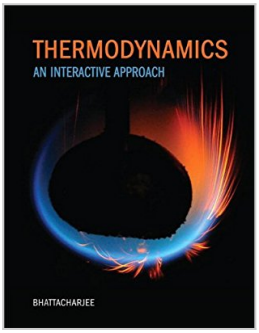


# Thermodynamics: An Interactive Approach

*By Subrata Bhattacharjee*



**Thermodynamics: An Interactive Approach** By Subrata Bhattacharjee

*For the thermodynamics course in the Mechanical & Aerospace Engineering department. This text also serves as a useful reference for anyone interested in learning more about thermodynamics.*

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*Thermodynamics: An Interactive Approach* employs a layered approach that introduces the important concepts of *mass*, *energy*, and *entropy* early, and progressively refines them throughout the text. To create a rich learning experience for today's thermodynamics student, this book melds traditional content with the web-based resources and learning tools of TEST: The Expert System for Thermodynamics (www.pearsonhighered.com/bhattacharjee)–an interactive platform that offers smart thermodynamic tables for property evaluation and analysis tools for mass, energy, entropy, and exergy analysis of open and closed systems.

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Beside the daemons–web-based calculators with a friendly graphical interface–other useful TEST modules include an animation library, rich Internet applications (RIAs), traditional charts and tables, manual and TEST solutions of hundreds of engineering problems, and examples and problems to supplement the textbook. The book is written in a way that allows instructors to decide the extent that TEST is integrated with homework or in the classroom.

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to lay a foundation for true understanding.

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## Editorial Review

About the Author

**Professor Subrata Bhattacharjee,** known by his friends as Sooby, earned a B.Tech. degree in Mechanical Engineering from Indian Institute of Technology, Kharagpur in 1983 and his Ph.D. from Washington State University, Pullman, USA in 1988. After two years of post-doctoral work on a NASA project, he joined San Diego State University in 1991 and currently holds Professorship in Mechanical Engineering Department and Adjunct Professorship in Computer Science Department.

Professor Bhattacharjee has been actively involved in research in radiation heat transfer, combustion, computational thermodynamics, and development of software for educational purposes. For his dissertation, he developed a modified two-flux method (Effective Angle Method) for calculating radiative source term and used this model to study two-way coupling between radiation and fluid dynamics in a laminar diffusion flame. Working on a project on jet flow in boundary layers, he came upon a new non-dimensional group that compares a known pressure drop with viscous forces. This number is being used in textbook and literature in connection with electronic cooling.

Throughout his research career, Dr. Bhattacharjee has been interested in uncovering the mechanism of flame spread over solid fuels, especially in a microgravity environment. His work helped establish the dominance of radiation heat transfer in near quiescent environment. He has been a PI and co-PI of several projects funded by NASA. Some of his contributions include: 1. Discovery of the phenomenon that flame over thick fuel bed in a quiescent microgravity environment self-extinguishes irrespective of the oxygen level; 2. Development of a formula for a critical thickness that renders a fuel thick in such an environment; 3. Development of two formulas for flame spread rate, one in the thin limit and one in the thick limit, which are the only flame spread formulas ever developed in the microgravity regime. Several of his experiments on flames over solids have been conducted aboard NASA's Space Shuttles, Sounding Rockets, and Russia's Mir Space Station. One of his recently proposed experiments is currently under design to be conducted in the International Space Station.

Under a current grant from NASA, Prof. Bhattacharjee and his team is building a 10 m tall Flame Tower at SDSU to conduct some fundamental experiments to predict the behavior of flames in a gravity free environment of a spacecraft. These ground based work is in support of the proposed space based experiment. In this work, researchers from Gifu University, Japan, are collaborating with SDSU.

Supported by NSF, Dr. Bhattacharjee has been developing a novel cyber infrastructure for multi-scale approach to thermodynamic data and chemical equilibrium services. Users can now plug in these services and "outsource" the data used in their thermofluids calculations. By simply altering key words such as NASA, NIST, or AB-INITIO, for example, they can change the source of data used in their research applications. Likewise, equilibrium calculations can be integrated into any CFD code written in FORTRAN, MATLAB, or any other language through a relatively new technology called web services. The chemical equilibrium program developed by Dr. Bhattacharjee's group is equally powerful as NASA's benchmark CEA and offers a built-in parallel architecture.

Prof. Bhattacharjee's passion for making thermodynamics easier to master led to the development of a web based software called TEST, the Expert System for thermodynamics

(www.pearsonhighered.com/bhattacharjee), which has been used by students, professionals and educators from around the world. Several articles and one book have been written about the use of TEST in thermodynamic education.

Winner of Outstanding Faculty Award, Monty Award at SDSU, Most Influential Faculty award, Faculty Friend Award, Outstanding Engineering Educator award, Best Paper award, and ASME Fellow award, Professor Bhattacharjee can be contacted at prof.bhattacharjee@gmail.com

## Users Review

**From reader reviews:**

**Connie Simpson:**

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**Jerry Day:**

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**Frances Lockhart:**

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