

Chapter 1

BASICS OF HEAT TRANSFER

Thermodynamics and Heat Transfer

1-1C Thermodynamics deals with the amount of heat transfer as a system undergoes a process from one equilibrium state to another. Heat transfer, on the other hand, deals with the rate of heat transfer as well as the temperature distribution within the system at a specified time.

1-2C (a) The driving force for heat transfer is the temperature difference. (b) The driving force for electric current flow is the electric potential difference (voltage). (a) The driving force for fluid flow is the pressure difference.

1-3C The caloric theory is based on the assumption that heat is a fluid-like substance called the "caloric" which is a massless, colorless, odorless substance. It was abandoned in the middle of the nineteenth century after it was shown that there is no such thing as the caloric.

1-4C The *rating* problems deal with the determination of the *heat transfer rate* for an existing system at a specified temperature difference. The *sizing* problems deal with the determination of the *size* of a system in order to transfer heat at a *specified rate* for a *specified temperature difference*.

1-5C The experimental approach (testing and taking measurements) has the advantage of dealing with the actual physical system, and getting a physical value within the limits of experimental error. However, this approach is expensive, time consuming, and often impractical. The analytical approach (analysis or calculations) has the advantage that it is fast and inexpensive, but the results obtained are subject to the accuracy of the assumptions and idealizations made in the analysis.

1-6C Modeling makes it possible to predict the course of an event before it actually occurs, or to study various aspects of an event mathematically without actually running expensive and time-consuming experiments. When preparing a mathematical model, all the variables that affect the phenomena are identified, reasonable assumptions and approximations are made, and the interdependence of these variables are studied. The relevant physical laws and principles are invoked, and the problem is formulated mathematically. Finally, the problem is solved using an appropriate approach, and the results are interpreted.

1-7C The right choice between a crude and complex model is usually the *simplest* model which yields *adequate* results. Preparing very accurate but complex models is not necessarily a better choice since such models are not much use to an analyst if they are very difficult and time consuming to solve. At the minimum, the model should reflect the essential features of the physical problem it represents.

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COMSOL5 for Engineers Mehrzad Tabatabaian, 2015-08-07 COMSOL5 Multiphysics is one of the most valuable software modeling tools for engineers and scientists This book introduces multiphysics modeling techniques and examples accompanied by practical applications using COMSOL5 x The mathematical fundamentals engineering principles and design criteria are presented as integral parts of the examples At the end of chapters are references that contain more in depth physics technical information and data these are referred to throughout the book and used in the examples

Nuclear Reactor Thermal Hydraulics Robert E. Masterson, 2019-08-21 Nuclear Thermal Hydraulic Systems provides a comprehensive approach to nuclear reactor thermal hydraulics reflecting the latest technologies reactor designs and safety considerations The text makes extensive use of color images internet links computer graphics and other innovative techniques to explore nuclear power plant design and operation Key fluid mechanics heat transfer and nuclear engineering concepts are carefully explained and supported with worked examples tables and graphics Intended for use in one or two semester courses the text is suitable for both undergraduate and graduate students A complete Solutions Manual is available for professors adopting the text

Parallel Computation A. E. Fincham, Brian J. Ford, 1993 This book came from a conference which surveyed the most recent research on numerical methods and the development of algorithms for use with parallel computers It is now widely accepted that parallel computing is the future the only way to achieve the processing speeds that are required to meet the needs of computer users in the future the software problems involved require the development of new solution algorithms which are capable of supporting many parallels The emphasis of the conference was on the applications of parallel processing on the implementation of specific applications on parallel computers or with the development of efficient mathematical algorithms to be used in applications The contributors include Mike Brady et al Oxford and Jeremy du Croz NAG UK

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