F-Chart Software

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EESy Solutions

Engineering Equation Solver Newsletter

Inside this issue:

Welcome

This is issue 30 of EESy Solutions, a newsletter that provides news, tips, and other updates for users of the Engineering Equation Solver software. This issue provides an overview of several books that have been published that incorporate the use of EES in a thorough way.

EES has been available for more than two decades. Previous issues of EESy Solutions can be downloaded from: http:/fchart.com/ees/eesy-solutions-newsletter.php.

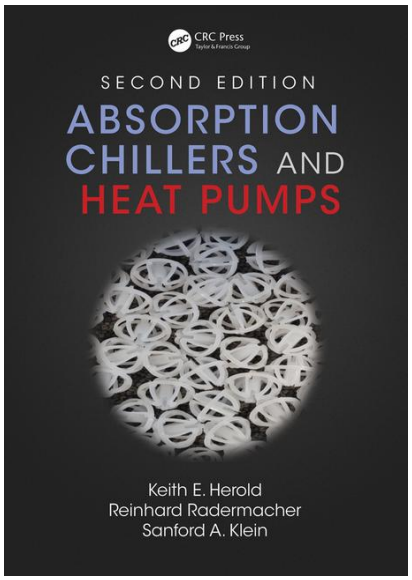
EES-Related Textbooks

EES eliminates the mathematical complexity involved in solving sets of simultaneous algebraic and differential equations that are the mathematical basis of complex problems. It provides a large bank of high-accuracy thermodynamic and transport property data and a library of heat transfer functions. In addition, the simulation results can be used to generate plots or be integrated with the sophisticated optimization algorithms. The integration of EES with a textbook provides readers with the capability to easily apply the theory presented in the book to solve interesting, real-world engineering problems. Since most of the mathematical complexity is eliminated using EES, tables and plots can be generated that provide a much richer understanding of the results of the analysis.

The integration of EES with text books has been well received and continues to be a popular pedagogical approach to instruction. This issue briefly summarizes several books that have successfully used this approach.

Absorption Chillers & Heat Pumps, 2nd Edition

K. Herold, R. Radermacher, and S. Klein (CRC Press, 2016)



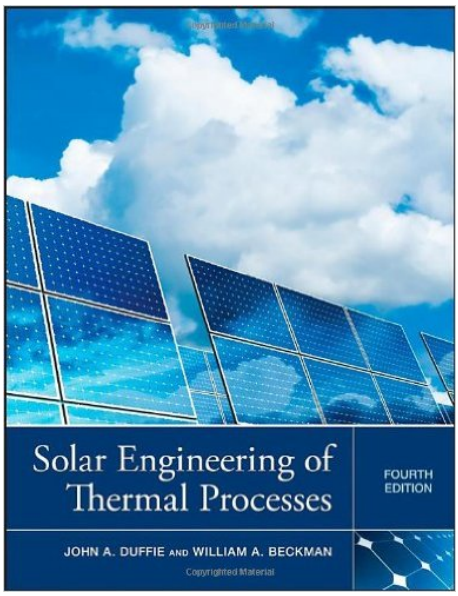
The increased global interest in sustainability and use of renewable energy has brought about a renewed interest in absorption heat pump technology. This book discusses the fundamental physics and applications of absorption chillers and heat pumps. In addition to providing an in-depth discussion of fundamental concepts related to absorption refrigeration technology, this book provides detailed modeling of a broad range of cycles using lithium-bromide and ammonia-water working fluids.

Absorption cycles are difficult to model because they are described by a large set coupled non-linear equations. The second edition of this book provides extensively revised examples written with the latest version of the EES. New LiBr/H2O property correlations and NH3/H2O helper functions in EES are used to significantly enhance readability and accuracy. Many worked examples are provided to link the theory to the application. All of the example EES files can be downloaded from http://fchart.com/ees/books.php.

- Introduction
- Absorption Cycle Fundamentals
- Properties of Working Fluids
- Thermodynamic Processes with Mixtures
- Overview of Water/Lithium Bromide Technology
- Single-Effect Water/Lithium Bromide Systems
- Double-Effect Water/Lithium Bromide Systems
- Advanced Water/Lithium Bromide Cycles
- Single-Stage Ammonia/Water Systems
- Two-Stage Ammonia/Water Systems
- Generator/Absorber Heat Exchange Cycles
- Diffusion-Absorption Cycle
- Applications of Absorption Chillers and Heat Pumps
- App. A: Using EES
- App. B: Absorption Cycle Modeling
- App. C: Modeling a Water/Lithium Bromide Absorption Chiller
- App. D: Modeling an Ammonia-Water Absorption Chiller
- App. E: The ABSIM Software Package
- App. F: Vapor Surfactant Theory

Solar Engineering of Thermal Processes, 4th Edition

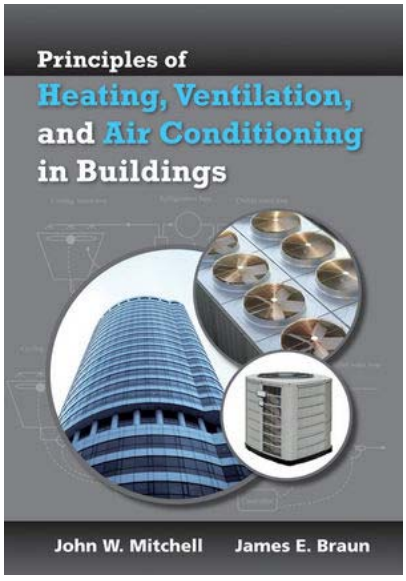
J. A. Duffie and W. A. Beckman (Wiley, 2013)



This book has become the classic solar engineering text and reference. The 4th edition offers current coverage of solar energy theory, systems design, and applications in different market sectors along with an emphasis on solar system design and analysis using simulations to help readers to translate theory into practice.

This book is an important resource for students of solar engineering, solar energy, and alternative energy as well as professionals working in the power and energy industry or related fields. The book features increased coverage of leading edge topics in solar energy. EES is used extensively in the book. Functions for most of the equations in the book are available in the SETP4 library that can be downloaded from http://fchart.com/ees/books.php.

- Introduction
- Solar Radiation
- Available Solar Radiation
- Selected Heat Transfer Topics
- Radiation Characteristics of Opaque Materials
- Radiation Transmission through Glazing
- Flat-Plate Collectors
- Concentrating Collectors
- Energy Storage
- Solar Process Loads
- System Thermal Calculations
- Solar Process Economics
- Solar Water Heating: Active and Passive
- Building Heating: Active
- Building Heating: Passive & Hybrid Methods
- Solar Cooling
- Solar Industrial Process Heat
- Solar Thermal Power Systems
- Solar Ponds: Evaporative Processes
- Simulations in Solar Process Design
- Design of Active Systems: f-Chart
- Design of Active Systems by Utilizability Methods
- Design of Passive and Hybrid Heating Systems
- Design of Photovoltaic Systems
- Wind Energy



Heating, Ventilation, and Air Conditioning in Buildings

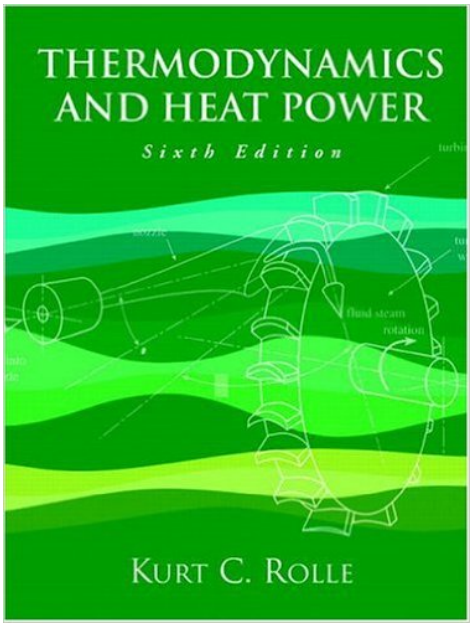
J. W. Mitchell and J. E. Braun (Wiley, 2013)

This book emphasizes application of engineering principles to the analysis of HVAC systems and related devices. The book integrates HVAC equipment analyses with models that are written using EES. This approach allows the equations describing HVAC equipment performance to be directly solved and used to produce plots that give insight into actual behavior. EES allows the examples, problems, and design projects to be more than exercises—instead they represent physical situations that an engineer might actually face in practice. The textbook provides a foundation for students and practicing engineers to design HVAC systems for buildings. Online EES examples are available on the textbook website.

- Introduction to Air-Conditioning Systems
- System Analysis Techniques and the use of EES
- Thermodynamics and Fluid Flow in HVAC Applications
- Heat Transfer in HVAC Applications
- Psychrometrics for HVAC Applications
- Overview of HVAC Systems
- Thermal Comfort and Air Quality
- Weather Data, Statistics, and Processing
- Components of Building Heat Loss and Gain
- Heating and Cooling Loads
- Air Distribution Systems
- Liquid Distribution Systems
- Heat Exchangers for Heating and Cooling Applications
- Cooling Towers and Desiccant Dehumidification Systems
- Vapor-Compression Refrigeration and Air-Conditioning Systems
- Heat Pump Systems
- Thermal Storage Systems
- Building and HVAC Energy Use
- HVAC Control Principles
- Supervisory Control
- Designing HVAC Systems

Thermodynamics and Heat Power, 6th Edition

K.C. Rolle (Pearson, 2005)



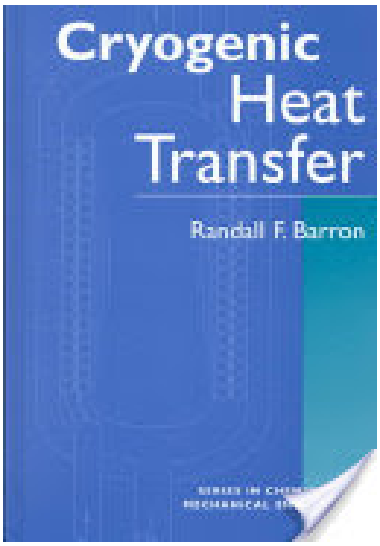
This text presents students with the fundamental concepts of thermodynamics and their practical application to heat power, heat transfer, and heating and air conditioning. It addresses real-world problems in engineering and design—rather than focusing on abstract mathematics. The text is designed specifically for use in engineering technology programs.

The textbook is tightly integrated with EES and provides students with models for analyzing many of the problems encountered in thermodynamics and heat power.

- Introduction
- The Thermodynamic System
- Work, Heat, and Reversibility
- Conservation of Mass and the First law of Thermodynamics
- Equations of State and Calorimetry
- Processes
- Heat Engines and the Second Law of Thermodynamics
- Availability and Useful Work
- The Internal Combustion Engine and the Otto and Diesel Cycles
- Gas Turbines, Jet Propulsion, and the Brayton Cycle
- Steam Power Generation and the Rankine Cycle
- Refrigeration and Heat Pumps
- Mixtures
- Reacting Mixtures and Combustion
- Heat Transfer
- Heating and Air Conditioning
- Other Power Devices

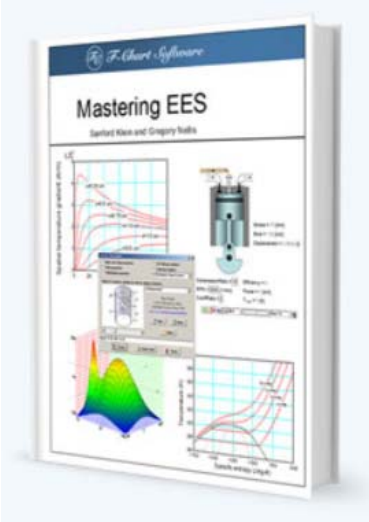
Cryogenic Heat Transfer, 2nd Edition

R. F. Barron and G. F. Nellis (Taylor Francis, May 2016)



This book is an updated and expanded version of the well-known first edition (pictured). The concepts of cryogenic heat transfer in conduction, convection and radiation are developed and explained, with numerous worked examples and problems. The new edition features integration of computational software methods using EES. Applications from a wide range of technical areas - including fuel processing, biomedical uses, MRI & nuclear magnetic resonance - are explained. The result is a unique book that can be used by professionals working with cryogenics and graduate students.

- Introduction
- One-Dimensional Steady Conduction Heat Transfer
- Lumped Capacitance Transient Heat Transfer
- Two-Dimensional Steady-State Conduction
- Transient Conduction with Spatial Gradients
- Single-Phase Convection Heat Transfer
- Two Phase Heat Transfer and Pressure Drop
- Radiation Heat Transfer
- Free Molecular Flow
- Cryogenic Heat Exchangers



Mastering EES (eBook)

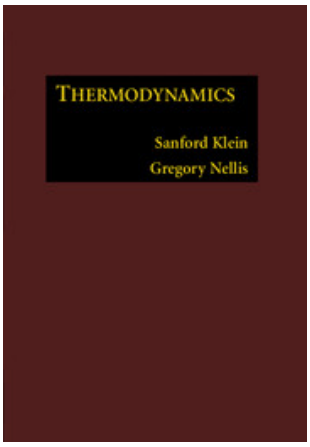
S.A. Klein and G.F. Nellis, (F-Chart Software, 2012-2016)

Mastering EES is a 760 page book that provides a comprehensive presentation of all of the features in the Commercial and Professional versions of EES, complete with many examples, including use of macros, Diagram window animations, integration with Python and serial communication capability. The book is intended both for those who have never used EES as well as for advanced users. The current version of this book is the 38th edition. Mastering EES will automatically open (and optionally download the latest version) when selected from the EES Help menu.

- Introduction to EES
- Curve Fitting & Interpolation
- Functions & Procedures
- Property Data
- Convergence and Debugging
- Optimization
- Integration
- Uncertainty Propagation
- Advanced Plotting
- Subprograms & Modules
- Library Files
- The Heat Transfer Library
- Complex Algebra
- Directives
- The Diagram Window
- Animations
- Executable/Distributable Programs
- The Report Window
- Macros
- External Functions & Procedures
- Integrating EES with other Programs

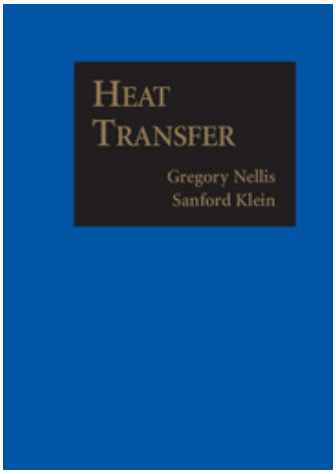
Thermodynamics

S. A. Klein and G. F. Nellis (Cambridge, 2011)



This book differs from other mechanical engineering thermodynamics textbooks in that its objective is to provide engineers with the concepts as well as the tools and experience needed to solve practical real-world energy problems. EES was originally developed to solve thermodynamics problems and this book is a result of this development. The presentation seamlessly integrates EES with theory to allow engineering students and practicing engineers to solve problems that otherwise would be difficult to solve. The use of examples, solved and explained in detail, and supported with property diagrams that are drawn to scale, is ubiquitous in this textbook. These examples are not trivial drill problems, but rather complex and timely real world problems that are of interest by themselves. As with the presentation, the solutions to these examples are complete and do not skip steps. The book includes many problems at the end of each chapter.

- Basic concepts
- Thermodynamic properties
- Energy & energy transport
- General application of the first law
- The second law of thermodynamics
- Entropy
- Exergy
- Power Cycles
- Refrigeration and heat pump cycles
- Property relations for pure fluids
- Mixtures & multi-component phase equilibrium
- Psychrometrics
- Combustion
- Chemical equilibrium
- Statistical thermodynamics
- Compressible Flow



Heat Transfer

G.F. Nellis and S. A. Klein (Cambridge, 2009)

The single objective of this book is to provide engineers with the capability, tools, and confidence to solve real-world heat transfer problems. It includes many advanced topics, such as Bessel functions, Laplace transforms, separation of variables, Duhamel's theorem, and complex combination, as well as high order explicit and implicit numerical integration algorithms. The many examples in the book are rather complex and timely real-world problems rather than trivial “textbook” exercises. This textbook integrates the computational software packages Maple, FEHT, MATLAB, and Engineering Equation Solver (EES) directly with the heat transfer theory.

- 1-D, steady-state conduction
- 2-D, steady-state conduction
- Transient conduction
- External forced convection
- Internal forced convection
- Natural convection
- Boiling and condensation
- Heat exchangers
- Mass transfer
- Radiation

EES files for all of the examples in both textbooks are available on http://fchart.com/ees/books.php.

RECENT IMPROVEMENTS

- The online help provides search capability.
- The **IsothermalCompress** function returns the isothermal compressibility of fluids.
- EES is able to directly call Python scripts just like EES procedures with its Call Python command.
- A **Check for New Version** menu item has been added to the Help menu. The command shows the date at which Instant Update and Technical Support (IUTS) expired and the current version of EES. In addition, it provides a direct link to the IUTS page of our website where the current EES version can be downloaded.
- The Alter Values dialog in a Parametric or Lookup Table allows variable names in either the primary or secondary units to be used to set the values in a table. (Professional version)
- The handling of units for arrays has been improved so that is easier to change the units of all elements at once. The Arrays table will display 'mixed' when the units of the elements in the array are not the same.
- A suite of commands (e.g., **Serial.Open** and **Serial.ReadChar**) have been added to the EES Macro capability in the Professional version to provide communications with an external device through the serial port. Documentation is provided in the online help along with an example of communication with the Arduino UNO.
- The objects in the Diagram window automatically resize for different display resolutions.
- The $RUNMACROAFTER directive (Professional version) allows macro commands to be embedded in the Equations window. These commands can be used to produce plots or other tasks.
- The $VARINFO directive allows the guess value, lower and upper bounds, units, and display format to be set for specified variables.
- The characters // indicate that all subsequent characters are a comment.

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Instant Update Service

EES uses a different model for updating than most other programs. Each time that there is a change in the EES program, either to correct a problem or to add a new feature, the version number is incremented by 0.001 and the latest version of EES is placed on our website. Although the program has become very robust and stable, about 200 new versions of EES were released in the last year.

Any user who has a current subscription to our Instant Update Service can download the latest version. The **Check for New Version** command in the **Help** menu streamlines this process. All new non-academic licenses of EES are provided with one year of Instant Update Service. The fee to continue Instant Update Service after the first year is 20% of the current cost of the program per year if renewed within 12 months after expiration of the Service.