

1. Record Nr.	UNINA9910627253803321
Autore	Dehli Martin
Titolo	Fundamentals of technical thermodynamics : textbook for engineering students / / Martin Dehli, Ernst Doering and Herbert Schedwill
Pubbl/distr/stampa	Wiesbaden, Germany : , : Springer, , [2023] ©2023
ISBN	3-658-38910-9
Descrizione fisica	1 online resource (622 pages)
Disciplina	536.7
Soggetti	Thermodynamics Engineering students
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references (pages 592-599) and index.
Nota di contenuto	Intro -- Foreword -- Table of Contents -- Important Formula Characters -- Authors Vita -- 1 Basic Thermodynamic Terms -- 1.1 Applications of Thermodynamics -- 1.2 System -- 1.3 State, State Variables, Changes of State -- 1.4 Process, Process Variables -- 2 The First Law of Thermodynamics -- 2.1 The Principle of Conservation of Energy -- 2.2 Potential Energy -- 2.3 Kinetic Energy -- 2.4 Work -- 2.4.1 Volume Change Work -- 2.4.2 Coupling Work -- 2.4.3 Shift Work -- 2.4.4 Pressure Change Work -- 2.4.5 Friction Work -- 2.5 Thermal Energy -- 2.5.1 Internal Energy -- 2.5.2 Heat -- 2.5.3 Enthalpy -- 2.6 Energy Balances -- 2.6.1 Energy Balance for the Closed System -- 2.6.2 Energy Balance for the Open System -- 2.7 Heat Capacity -- 2.7.1 Specific Heat Capacity -- 2.7.2 The Specific Heat Capacity of Gases -- 2.8 Fluid Mechanics -- 2.8.1 General Aspects -- 2.8.2 Flow Shapes -- 2.8.3 Friction and Roughness -- 2.8.4 Individual Resistances -- 2.8.5 Equivalent Pipe Length -- 3 The Second Law of Thermodynamics -- 3.1 The Statement of the Second Law -- 3.1.1 Reversible and Irreversible Processes -- 3.1.2 Quasi-Static Changes of State -- 3.2 Irreversible Processes -- 3.2.1 Friction -- 3.2.2 Temperature Equalisation -- 3.2.3 Pressure Equalisation -- 3.3 Entropy -- 3.3.1 Reversible Substitute Processes of Adiabatic Processes -- 3.3.2 The Calculation of the Entropy Change -- 3.3.3 Entropy as a State Variable, Total Differential -- 3.4 The Entropy Change of Irreversible Processes -- 3.4.1 Friction

-- 3.4.2 Temperature Equalisation -- 3.4.3 Pressure Equalisation --
 3.4.4 Throttling -- 3.5 Non-Adiabatic Process and Reversible
 Substitute Process -- 3.5.1 Isentropic Change of State --
 Interpretations of Entropy -- 3.5.2 Entropy Diagrams -- 3.5.3 Circular
 Integral, Thermodynamic Temperature -- 3.5.4 Dissipative Energy -- 4
 Ideal Gases -- 4.1 Thermal Equation of State.
 4.1.1 Law of Boyle and Mariotte -- 4.1.2 Law of Gay-Lussac -- 4.1.3
 Physical Norm State -- 4.1.4 Gas Thermometer -- 4.1.5 Specific Gas
 Constant -- 4.1.6 Universal Gas Constant -- 4.2 Caloric State Variables
 of Ideal Gases -- 4.2.1 Internal Energy -- 4.2.2 Enthalpy -- 4.2.3
 Entropy -- 4.3 Changes of State -- 4.3.1 Isochoric Change of State --
 4.3.2 Isobaric Change of State -- 4.3.3 Isothermal Change of State --
 4.3.4 Isentropic Change of State -- 4.3.5 Polytropic Change of State --
 4.3.6 Changes of State with Variable Mass -- 4.4 Specific Thermal
 Energy and Specific Work in the T,s Diagram -- 4.5 Mixtures of Ideal
 Gases -- 4.5.1 The Mixing Process in the Closed System -- 4.5.2 The
 Mixing Process Without Total Volume Change -- 4.5.3 The Mixing
 Process Without Temperature Change, Pressure Change and Total
 Volume Change -- 4.5.4 The Mixing Process in the Open System -- 4.6
 Dynamics of Ideal Gases: Compressible Stationary Gas Flow -- 4.6.1
 Introduction -- 4.6.2 Velocity of Sound and Propagation of Sound --
 4.6.3 Energy Equation and Bernoulli Equation of Compressible One-
 Dimensional Ideal Gas Flow -- 4.6.4 Stagnation State Variables and
 Critical State -- 4.6.5 The Velocity Diagram of the Specific Energy
 Equation -- 4.6.6 Flow Function -- 4.6.7 Isentropic Gas Flow in
 Nozzles and Orifices -- 4.6.8 Accelerated Compressible Flow -- 4.6.9
 Compression Shock -- 5 Real Gases and Vapors -- 5.1 Properties of
 Vapors -- 5.1.1 Phase Transitions -- 5.1.2 Two-Phase Regions --
 5.1.3 Boiling and Condensing -- 5.1.4 Evaporation and Thawing --
 5.1.5 Liquid -- 5.1.6 Two-Phase Liquid-Vapor State -- 5.1.7
 Superheated Vapor -- 5.2 State Diagrams -- 5.2.1 The p,v,T Surface --
 5.2.2 The T,s Diagram -- 5.2.3 The h,s Diagram -- 5.3 Thermal
 Equations of State -- 5.3.1 The van der Waals Equation -- 5.3.2 The
 Boundary Curve and the Maxwell Relation.
 5.3.3 The Reduced van der Waals Equation -- 5.3.4 Different
 Approaches -- 5.3.5 Virial Coefficients -- 5.4 Calculation of State
 Variables -- Property Tables -- 5.4.1 The Caloric State Variables --
 5.4.2 The Specific Heat Capacities c_p and c_v -- 5.4.3 The Isentropic
 Exponent and the Isothermal Exponent -- 5.4.4 The Clausius-
 Clapeyron Equation -- 5.4.5 Free Energy and Free Enthalpy -- 5.4.5.1
 General -- 5.4.5.2 A g,s Diagram for Water and Steam -- 5.4.6 The
 Joule-Thomson Effect -- 6 Thermal Machines -- 6.1 Classification and
 Types of Machines -- 6.1.1 Classification According to the Direction of
 Energy Conversion -- 6.1.2 Classification According to the
 Construction of the Machines -- 6.1.3 Classification According to the
 Type of Process Taking Place -- 6.2 Ideal Machines -- 6.2.1
 Compression and Expansion in Ideal Machines -- 6.2.2 Multi-Stage
 Compression and Expansion -- 6.2.3 The Energy Balance for Flow
 Machines -- 6.2.4 The Energy Balance for Displacement Machines --
 6.3 Energy Balances for Real Machines -- 6.3.1 Internal or Indexed
 Work -- 6.3.2 Total Work -- 6.3.3 Total Enthalpy -- 6.4 Real Machines
 -- 6.4.1 The Uncooled Compressor -- 6.4.2 The Cooled Compressor --
 6.4.3 Piston Compressor -- 6.4.4 Turbo Compressor -- 6.4.5 Gas and
 Steam Turbines -- 6.5 Efficiencies -- 6.5.1 Comparison Processes --
 6.5.2 The Internal Efficiency -- 6.5.3 The Mechanical Efficiency -- 6.5.4
 The Total Efficiency -- 6.5.5 The Isentropic Efficiency -- 6.5.6 The
 Isothermal Efficiency -- 6.5.7 The Polytropic Efficiency -- 7 Cyclic
 Processes -- 7.1 Cyclic Process Work, Heat Input and Heat Output --

7.2 Right-Hand and Left-Hand Cyclic Processes -- 7.3 The Theory of Right-Hand Cyclic Processes -- 7.3.1 Conversion of Thermal to Mechanical Energy -- 7.3.2 Thermal Efficiency -- 7.3.3 Right-Hand Carnot Process -- 7.3.4 Effect of Irreversible Processes -- 7.3.5 Carnot Factor.

7.4 Technically Used Right-Hand Cyclic Processes -- 7.4.1 Seiliger Process, Otto Process, Diesel Process, Generalised Diesel Process -- 7.4.2 Joule Process -- 7.4.3 Ericsson Process -- 7.4.4 Stirling Process -- 7.4.5 Single-Polytropic Carnot Process -- 7.4.6 Gas Expansion Process -- 7.4.7 Clausius-Rankine Process -- 7.5 Comparative Evaluation of Right-Hand Cyclic Processes -- 7.5.1 Process Variables and Cyclic Processes -- 7.5.2 Mechanical Effort Ratios and Thermal Effort Ratios -- 7.5.3 Evaluation Criteria For Important Thermodynamic Cyclic Processes -- 7.5.3.1 General Thermodynamic Relations -- 7.5.3.2 Examples -- 7.5.3.3 Graphical Representation of the Thermodynamic Relations -- 7.5.3.4 Cyclic Process Calculations for Real Fluids -- 7.6 Left-Hand Cyclic Processes -- 7.6.1 Performance Number -- 7.6.2 Left-Hand Carnot Process -- 7.6.3 Left-Hand Joule Process -- 7.6.4 Gas Expansion Process as a Left-Hand Cycle Process -- 7.6.5 Cold Vapor Compression Process -- 8 Exergy -- 8.1 Energy and Exergy -- 8.1.1 Exergy of Heat -- 8.1.2 Exergy of Bound Energy -- 8.1.3 Exergy of Temperature Change Heat -- 8.1.4 Exergy of Volume Change Work -- 8.1.5 Exergy of Shift Work -- 8.1.6 Exergy of Pressure Change Work -- 8.1.7 Exergy of Internal Energy -- 8.1.8 Exergy of Enthalpy -- 8.1.9 Exergy of Free Energy -- 8.1.10 Exergy of Free Enthalpy -- 8.1.11 Difference between EU and EF -- 8.1.12 Difference between EH and EG -- 8.1.13 Free Energy and Free Enthalpy as Thermodynamic Potentials -- 8.2 Exergy and Anergy -- 8.2.1 Anergy in a p, V Diagram and in a T,S Diagram -- 8.2.2 Anergy-Free Energies -- 8.3 Exergy Loss -- 8.3.1 Irreversibility and Exergy Loss -- 8.3.2 Exergy Loss and Anergy Gain -- 8.3.3 Exergetic Efficiencies -- 9 Heat Transfer -- 9.1 Heat Radiation -- 9.1.1 Stefan-Boltzmann Law -- 9.1.2 Kirchhoff 's Law -- 9.1.3 Planck's Radiation Law. -- 9.1.4 Wien's Displacement Law -- 9.1.5 Lambert's Cosine Law -- 9.1.6 Irradiance Number -- 9.2 Radiation Exchange -- 9.2.1 Cavity Method -- 9.2.2 Envelopment of One Surface by Another -- 9.2.3 Two Parallel Surfaces of Equal Size -- 9.2.4 Matrix Representation -- 9.3 Stationary One-Dimensional Heat Conduction -- 9.3.1 Plane Wall -- 9.3.2 Pipe Wall -- 9.4 Instationary One-Dimensional Heat Conduction -- 9.4.1 Plane Single-Layer Wall -- 9.4.2 Semi-Infinite Body -- 9.5 Heat Transfer by Convection -- 9.5.1 Heat Transfer Coefficient -- 9.5.2 Similarity Theory -- 9.5.3 Reynolds Analogy -- 9.5.4 Prandtl Analogy -- 9.5.5 Power Number Approaches for Laminar and Turbulent Flow -- 9.5.6 Approaches for Phase Transitions -- 9.6 Over-All Heat Transfer -- 9.6.1 Over-All Heat Transfer Coefficient -- 9.6.2 Fin Efficiency and Area Efficiency -- 9.6.3 Mean Temperature Difference -- 9.6.4 Operating Characteristic (Effectiveness) -- 9.7 Finned Heat Transfer Surfaces -- 9.7.1 Straight Fin with Rectangular Cross-Section -- 9.7.2 Circular Fin with Rectangular Cross-Section -- 9.8 Partition Wall Heat Exchangers -- 9.8.1 Unidirectional Flow Heat Exchanger -- 9.8.2 Counterflow Heat Exchanger -- 9.8.3 Crossflow Heat Exchanger -- 9.8.4 Heat Transfer with Phase Transition in a Heat Exchanger -- 9.9 Evaluation and Design -- 9.9.1 Correction Factor for a Crossflow Heat Exchanger -- 9.9.2 Representation of the Operating Characteristic -- 9.9.3 Longitudinal Heat Conduction in a Plane Partition Wall -- 9.9.4 Design Diagram -- 10 Humid Air -- 10.1 State Variables of Humid Air -- 10.1.1 Relative Humidity -- 10.1.2 Humidity Ratio and Saturation -- 10.1.3 Specific Enthalpy -- 10.2 Changes of State of Humid Air --

10.2.1 Temperature Change -- 10.2.2 Humidification and
Dehumidification -- 10.2.3 Mixing of Two Humid Air Quantities --
10.3 The h,x Diagram of Mollier -- 10.3.1 Temperature Change.
10.3.2 Humidification and Dehumidification.
