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Heywood internal combustion engine fundamentals second edition pdf

Skip to Main Content Skip Nav Destination The future of the internal combustion engine, with some 2 billion in use in the world today, was a hot topic at last week's Society of Automotive Engineers (SAE) World Congress in Detroit. There, John Heywood, the Sun Jae Professor Emeritus of Mechanical Engineering at MIT, joined auto industry propulsion system leaders on a panel addressing the theme, "Not Dead Yet — The Ever Evolving Internal Combustion Engine Powertrain." Heywood is recognized as one of the world's preeminent experts on internal combustion engines. In the late 1960s, Heywood joined MIT's Sloan Automotive Lab, where he started researching why engines created air pollutants and how the amount of those pollutants could be reduced. Heywood thrived in this important emerging area of study. His research over the past five decades has substantially increased our understanding of how engines work, how they can be designed to reduce their emissions of air pollutants and greenhouse gases, and how to improve their fuel economy. Thirty years after its first publication, Heywood has just completed a second edition of his seminal book, "Internal Combustion Engine Fundamentals." Its publication comes at a critical time when the automotive industry is faced with difficult questions on how to move forward in an era when alternative propulsion options are getting a lot of attention. Q: Much of your career has focused on internal combustion engines. What changes have been made in engine design to reduce air pollutant and greenhouse gas emissions? A: In the past 30 years, there's been a lot of progress in controlling air pollutant emissions using exhaust after-treatment technology. The key technology component is the catalytic converter in the exhaust system that cleans up the exhaust gases before they go out into the atmosphere. Within these catalytic converters there's a honeycomb-like matrix with lots of passages with porous surfaces that maximize gas-to-surface contact. Noble metals like platinum, rhodium, and palladium are then spread over this surface area. These metals act as a catalyst that helps get rid of the pollutants at temperatures readily achievable in the exhaust system. As the exhaust gas goes through these channels, unburned fuel is oxidized and oxygen is removed from nitric oxide. It's a clever combination of engineering and chemistry. This has been very successful in gasoline engines, but not as successful for diesel engines. As a consequence, the environmental problems presented by diesel engines haven't yet been adequately resolved. Q: Over the past decade or so, there has been a strong focus on electric vehicles as a solution to transportation's greenhouse gas emissions problem. Why is work on internal combustion engines still important? A: Behind this question, there's this implication: "Why are you tothing with engines when electric vehicles are taking over?" Electric vehicles are certainly going to play a useful role moving forward, but right now it is really difficult to estimate how big a role they will eventually play. I've been researching the critical area of electrical vehicle recharging for MIT Energy Initiatives' "Mobility of the Future" project. If you own a battery electric vehicle, you really need a home charger. The logistics and cost of having a home charger at most of the homes in America is problematic and expensive. Various projections for the U.S. suggest that by 2030, some 10 to 25 percent of vehicles might be electrified. The question then remains, what about the other 90 to 75 percent? And what about the large trucks and ships that run on diesel fuel? There are, as yet, no convincing electric options for those vehicles. That is why it is still so important to continue working on internal combustion engines and make them as clean and efficient as we can. The SAE panel members agreed. Q: The EPA recent issued a report saying that the auto industry is unlikely to meet the greenhouse gas emissions regulations set for model years 2021 to 2025. What is your perspective on this? A: There are several implications of this recent assessment by the EPA for the automotive industry. Some dozen states have joined California, which was a key partner with the EPA in the setting of these ambitious standards during the Obama administration, and they are unlikely to back down. This could result in having more demanding standards for California and the dozen states that agree with the tougher regulations, with the remaining states following the EPA's requirements. Having different standards in different states would be a real headache for the auto industry. My hope is that through negotiations, these parties will agree on an appropriate compromise: likely a delay of the original standards for a few years. In a report I and co-workers wrote as part of an MIT's Energy Initiative project, we concluded that these 2021 to 2025 emission standards could be met within an additional five years beyond the target dates. Given the challenges in bringing the needed technologies into production vehicles quickly enough, and the shift in consumer's preferences to larger, heavier, crossover vehicles and SUVs, it's understandable why a delay might be needed. But this new EPA report has thrown a monkey wrench into this situation. Articles Catalog Databases Journals UWDC ASK Accounts & Lists UW Give Heywood, John B. Internal Combustion Engine Fundamentals. New York :McGraw-Hill, 1988. Heywood, John B. (1988). Internal combustion engine fundamentals. New York :McGraw-Hill, Heywood, John B. Internal Combustion Engine Fundamentals. New York :McGraw-Hill, 1988. warning Note: These citations are software generated and may contain errors. To verify accuracy, check the appropriate style guide. Close Export to Citation Manager (RIS) Back to item Skip to main content x You do not have access to this PDF. You must log in to an AccessEngineering personal account that has been granted instructor rights to access instructor resources. Your IP address is 95.216.64.229 Troubleshooter page Scroll to the top of the page. The long-awaited revision of the most respected resource on Internal Combustion Engines –covering the basics through advanced operation of spark-ignition and diesel engines. Written by one of the most recognized and highly regarded names in internal combustion engines this trusted educational resource and professional reference covers the key physical and chemical processes that govern internal combustion engine operation and design. Internal Combustion Engine Fundamentals, Second Edition, has been thoroughly revised to cover recent advances, including performance enhancement, efficiency improvements, and emission reduction technologies. Highly illustrated and cross referenced, the book includes discussions of these engines' environmental impacts and requirements. You will get complete explanations of spark-ignition and compression-ignition (diesel) engine operating characteristics as well as engine flow and combustion phenomena and fuel requirements. Coverage includes: *Engine types and their operation *Engine design and operating parameters *Thermochemistry of fuel-air mixtures *Properties of working fluids *Ideal models of engine cycles *Gas exchange processes *Mixture preparation in spark-ignition engines *Charge motion within the cylinder *Combustion in spark-ignition engines *Combustion in compression-ignition engines *Pollutant formation and control *Engine heat transfer *Engine friction and lubrication *Modeling real engine flow and combustion processes *Engine operating characteristics Table of Contents Preface xv Acknowledgments xvii Commonly Used Symbols, Subscripts, and Abbreviations Chapter 1 Engine Types and Their Operation 1 (52) 1.1 Introduction and Historical Perspective 1 (6) 1.2 Engine Classifications 7 (1) 1.3 Engine Operating Cycles 8 (3) 1.4 Engine Components 11 (3) 1.5 Multicylinder Engines 14 (2) 1.6 Spark-Ignition Engine Operation 16 (3) 1.7 Different Types of Four-Stroke SI Engines 19 (13) 1.7.1 Spark-Ignition Engines with Port Fuel 20 (1) Injection 1.7.2 SI Engines for Hybrid Electric 21 (3) Vehicles 1.7.3 Boosted SI Engines 24 (2) 1.7.4 Direct-Injection SI Engines 26 (3) 1.7.5 Prechamber SI Engines 29 (1) 1.7.6 Rotary Engines 30 (2) 1.8 Compression-Ignition Engine Operation 32 (5) 1.9 Different Types of Diesel Engines 37 (2) 1.10 Two-Stroke Cycle Engine Operation 39 (5) 1.11 Fuels 44 (5) 1.11.1 Gasoline and Diesel 44 (3) 1.11.2 Alternative Fuels 47 (2) Problems 49 (1) References 50 (3) Chapter 2 Engine Design and Operating Parameters 53 (28) 2.1 Important Engine Characteristics 53 (1) 2.2 Geometrical Relationships for 54 (3) Reciprocating Engines 2.3 Forces in Reciprocating Mechanism 57 (2) 2.4 Brake Torque and Power 59 (1) 2.5 Indicated Work per Cycle 60 (3) 2.6 Mechanical Efficiency 63 (1) 2.7 Mean Effective Pressure 64 (2) 2.8 Specific Fuel Consumption and Efficiency 66 (1) 2.9 Air/Fuel and Fuel/Air Ratios 67 (1) 2.10 Volumetric Efficiency 68 (1) 2.11 Specific Power, Specific Weight, and 68 (1) Specific Volume 2.12 Correction Factors for Power and 69 (1) Volumetric Efficiency 2.13 Specific Emissions and Emissions Index 70 (1) 2.14 Relationships between Performance 71 (2) Parameters 2.15 Engine Design and Performance Data 73 (3) 2.16 Vehicle Power Requirements 76 (1) Problems 77 (3) References 80 (1) Chapter 3 Thermochemistry of Fuel-Air Mixtures 81 (36) 3.1 Characterization of Flames 81 (3) 3.2 Ideal Gas Model 84 (1) 3.3 Composition of Air and Fuels 84 (4) 3.4 Combustion Stoichiometry 88 (3) 3.5 The First Law of Thermodynamics and 91 (10) Combustion 3.5.1 Energy and Enthalpy Balances 91 (3) 3.5.2 Enthalpies of Formation 94 (3) 3.5.3 Heating Values 97 (2) 3.5.4 Adiabatic Combustion Processes 99 (1) 3.5.5 Combustion Efficiency of an Internal 100 (1) Combustion Engine 3.6 The Second Law of Thermodynamics Applied 101 (3) to Combustion 3.6.1 Entropy 101 (1) 3.6.2 Maximum Work from an Internal 102 (2) Combustion Engine and Efficiency 3.7 Chemically Reacting Gas Mixtures 104 (9) 3.7.1 Chemical Equilibrium 104 (5) 3.7.2 Chemical Reaction Rates 109 (4) Problems 113 (2) References 115 (2) Chapter 4 Properties of Working Fluids 117 (52) 4.1 Introduction 117 (1) 4.2 Unburned Mixture Composition 118 (5) 4.3 Gas Property Relationships 123 (2) 4.4 A Simple Analytic Ideal Gas Model 125 (3) 4.5 Thermodynamic Property Charts 128 (11) 4.5.1 Unburned Mixture Charts 128 (3) 4.5.2 Burned Mixture Charts 131 (3) 4.5.3 Relation between Unburned and Burned 134 (5) Mixture Charts 4.6 Tables of Properties and Composition 139 (3) 4.7 Computer Routines for Property and 142 (9) Computation Calculations 4.7.1 Unburned Mixtures 142 (4) 4.7.2 Burned Mixtures 146 (5) 4.8 Transport Properties 151 (3) 4.9 Exhaust Gas Composition 154 (9) 4.9.1 Species Concentration Data 155 (2) 4.9.2 Equivalence Ratio Determination from 157 (5) Exhaust Gas Compositions 4.9.3 Effects of Fuel/Air Ratio 162 (1) Nonuniformity 4.9.4 Combustion Inefficiency 163 (1) Problems 163 (3) Chapter 5 Ideal Models of Engine Cycles 169 (42) 5.1 Introduction 169 (1) 5.2 Ideal Models of Engine Cycles 170 (2) 5.3 Thermodynamic Relations for Engine 172 (5) Processes 5.4 Cycle Analysis for an Ideal Gas Working 177 (8) Fluid with cv and cp Constant 5.4.1 Constant-Volume Cycle 177 (3) 5.4.2 Limited and Constant-Pressure Cycles 180 (1) 5.4.3 Cycle Comparison 181 (4) 5.5 Fuel-Air Cycle Analysis 185 (6) 5.5.1 SI Engine Cycle Simulation 185 (3) 5.5.2 CI Engine Cycle Simulation 188 (1) 5.5.3 Results of Cycle Calculations 189 (2) 5.6 Overexpanded Engine Cycles 191 (2) 5.7 Availability Analysis of Engine Processes 193 (7) 5.7.1 Availability Relationships 193 (2) 5.7.2 Entropy Changes in Ideal Cycles 195 (1) 5.7.3 Availability Analysis of Ideal Cycles 196 (2) 5.7.4 Effect of Equivalence Ratio 198 (2) 5.8 Comparison with Real Engine Cycles 200 (4) Problems 204 (5) References 209 (2) Chapter 6 Gas Exchange Processes 211 (84) 6.1 Intake and Exhaust Processes in the 212 (4) Four-Stroke Cycle 6.2 Volumetric Efficiency 216 (15) 6.2.1 Quasi-Static Effects 217 (2) 6.2.2 Intake and Exhaust Flow Resistances 219 (4) 6.2.3 Intake and In-Cylinder Heat Transfer 223 (1) 6.2.4 Intake Valve Timing Effects 223 (1) 6.2.5 Airflow Choking at Intake Valve 224 (1) 6.2.6 Intake and Exhaust Tuning 225 (3) 6.2.7 Combined Effects: Naturally-Aspirated 228 (1) Engines 6.2.8 Effects of Turbocharging 229 (2) 6.3 Flow through Valves and Ports 231 (14) 6.3.1 Valve and Port Geometry and Operation 231 (5) 6.3.2 Flow Rates and Discharge Coefficients 236 (4) 6.3.3 Variable Valve Timing and Control 240 (5) 6.4 Residual Gas Fraction 245 (1) 6.5 Exhaust Gas Flow Rate and Temperature 246 (4) Variation 6.6 Scavenging in Two-Stroke Cycle Engines 250 (10) 6.6.1 Two-Stroke Engine Configurations 250 (10) 6.6.2 Scavenging Parameters and Models 253 (2) 6.6.3 Actual Scavenging Processes 255 (5) 6.7 Flow through Two-Stroke Engine Ports 260 (5) 6.8 Supercharging and Turbocharging 265 (24) 6.8.1 Methods of Power Boosting 265 (1) 6.8.2 Basic Relationships 266 (6) 6.8.3 Compressors 272 (6) 6.8.4 Turbines 278 (6) 6.8.5 Compressor, Engine, Turbine Matching 284 (2) 6.8.6 Wave-Compression Devices 286 (3) Problems 289 (3) References 292 (3) Chapter 7 Mixture Preparation in SI Engines 295 (52) 7.1 Spark-Ignition Engine Mixture Requirements 295 (3) 7.2 Fuel Metering Overview 298 (6) 7.2.1 Mixture Formation Approaches 298 (1) 7.2.2 Relevant Characteristics of Fuels 299 (5) 7.3 Central (Throttle-Body) Fuel Injection 304 (1) 7.4 Port (Multiport) Fuel Injection 305 (7) 7.4.1 System Layout, Components, and 305 (4) Function 7.4.2 Fuel Spray Behavior 309 (3) 7.4.3 Reverse Flow Impacts 312 (1) 7.5 Air Flow Phenomena 312 (7) 7.5.1 Flow Past the Throttle Plate 312 (2) 7.5.2 Flow in Intake Manifolds 314 (4) 7.5.3 Air Flow Models 318 (1) 7.6 Fuel Flow Phenomena: Port Fuel Injection 319 (8) 7.6.1 Liquid Fuel Behavior 319 (6) 7.6.2 Transients: Fuel-Film Models 325 (2) 7.7 Direct Fuel Injection 327 (8) 7.7.1 Overview of Direct-Injection 327 (1) Approaches 7.7.2 DI Mixture Preparation Processes 327 (5) 7.7.3 DI Engine System and Components 332 (3) 7.8 Exhaust Gas Oxygen Sensors 335 (4) 7.9 Fuel Supply Systems 339 (2) 7.10 Liquid Petroleum Gas and Natural Gas 341 (1) Problems 342 (2) References 344 (3) Chapter 8 Charge Motion within the Cylinder 347 (50) 8.1 Intake-Generated Flows 347 (5) 8.2 Mean Velocity and Turbulence 352 (12) Characteristics 8.2.1 Definitions of Relevant Parameters 352 (5) 8.2.2 Application to Engine Velocity Data 357 (7) 8.3 Swirl 364 (8) 8.3.1 Swirl Measurement 365 (2) 8.3.2 Swirl Generation during Induction 367 (3) 8.3.3 Swirl Modification within the Cylinder 370 (2) 8.4 Tumble 372 (3) 8.5 Piston-Generated Flows: Squish 375 (5) 8.6 Swirl, Tumble, Squish Flow Interactions 380 (5) 8.7 Prechamber Engine Flows 385 (2) 8.8 Crevice Flows and Blowby 387 (4) 8.9 Flows Generated by Piston Cylinder-Wall 391 (2) Interaction Problems 393 (1) References 394 (3) Chapter 9 Combustion in Spark-Ignition Engines 397 (122) 9.1 Essential Features of Process 397 (7) 9.1.1 Combustion Fundamentals 397 (3) 9.1.2 SI Engine Combustion Process 400 (4) 9.2 Thermodynamics of SI Engine Combustion 404 (15) 9.2.1 Burned and Unburned Mixture States 404 (6) 9.2.2 Analysis of Cylinder Pressure Data 410 (5) 9.2.3 Combustion Process Characterization 415 (4) 9.3 Flame Structure and Speed 419 (26) 9.3.1 Overall Observations 419 (6) 9.3.2 Flame Structure 423 (7) 9.3.3 Laminar Burning Speeds 430 (4) 9.3.4 Flame Propagation Relations 434 (8) 9.3.5 Combustion with Direct Fuel Injection 442 (3) 9.4 Cyclic Variations in Combustion, Partial 445 (11) Burning, and Misfire 9.4.1 Observations and Definitions 445 (5) 9.4.2 Causes of Cycle-by-Cycle and 450 (3) Cylinder-to-Cylinder Variations 9.4.3 Partial Burning, Misfire, and Engine 453 (3) Stability 9.5 Spark Ignition 456 (19) 9.5.1 Ignition Fundamentals 457 (7) 9.5.2 Standard Ignition Systems 464 (4) 9.5.3 Alternative Ignition Approaches 468 (7) 9.6 Abnormal Combustion: Spontaneous Ignition 475 (35) and Knock 9.6.1 Description of Phenomena 475 (7) 9.6.2 Knock Fundamentals 482 (11) 9.6.3 Fuel Factors 493 (7) 9.6.4 Sporadic Preignition and Knock 500 (2) 9.6.5 Knock Suppression 502 (8) Problems 510 (5) References 515 (4) Chapter 10 Combustion in Compression-Ignition 519 (82) Engines 10.1 Essential Features of Process 519 (2) 10.2 Types of Diesel Combustion Systems 521 (3) 10.2.1 Direct-Injection Systems 521 (1) 10.2.2 Other Diesel Combustion Systems 521 (2) 10.2.3 Comparison of Different Combustion 523 (1) Systems 10.3 Diesel Engine Combustion 524 (18) 10.3.1 Optical Studies of Diesel Combustion 524 (6) 10.3.2 Combustion in Direct-Injection 530 (3) Multi-Spray Systems 10.3.3 Heat-Release-Rate Analysis 533 (5) 10.3.4 Conceptual Model of DI Diesel 538 (4) Combustion 10.4 Fuel Spray Behavior 542 (27) 10.4.1 Fuel Injection 542 (5) 10.4.2 Overall Spray Structure 547 (4) 10.4.3 Atomization and Spray Development 551 (3) 10.4.4 Spray Penetration 554 (4) 10.4.5 Droplet Size Distribution 558 (3) 10.4.6 Spray Evaporation 561 (8) 10.5 Ignition Delay 569 (14) 10.5.1 Definition and Discussion 569 (2) 10.5.2 Fuel Ignition Quality 571 (1) 10.5.3 Autoignition and Premixed Burn 572 (4) 10.5.4 Physical Factors Affecting Ignition 576 (2) Delay 10.5.5 Effect of Fuel Properties 578 (3) 10.5.6 Correlations for Ignition Delay in 581 (2) Engines 10.6 Mixing-Controlled Combustion 583 (7) 10.6.1 Background 583 (1) 10.6.2 Spray and Flame Structure 583 (4) 10.6.3 Fuel-Air Mixing and Burning Rates 587 (3) 10.6.4 Alternative Compression-Ignition 590 (6) Combustion Approaches 10.7.1 Multiple-Injection Diesel Combustion 591 (1) 10.7.2 Advanced Compression-Ignition 592 (4) Combustion Concepts Problems 596 (1) References 597 (4) Chapter 11 Pollutant Formation and Control 601 (114) 11.1 Nature and Extent of Problem 601 (5) 11.2 Nitrogen Oxides 606 (17) 11.2.1 Kinetics of NO Formation 606 (4) 11.2.2 Formation of NO2 610 (1) 11.2.3 NO Formation in Spark-Ignition 611 (6) Engines 11.2.4 NOx Formation in 617 (6) Compression-Ignition Engines 11.3 Carbon Monoxide 623 (3) 11.4 Hydrocarbon Emissions 626 (32) 11.4.1 Background 626 (2) 11.4.2 Flame Quenching and Oxidation 628 (2) Fundamentals 11.4.3 HC Emissions from Spark-Ignition 630 (23) Engines 11.4.4 Hydrocarbon Emission Mechanisms in 653 (5) Diesel Engine 11.5 Particulate Emissions 658 (20) 11.5.1 Spark-Ignition Engine Particulates 659 (1) 11.5.2 Characteristics of Diesel 660 (6) Particulates 11.5.3 Particulate Distribution within the 666 (1) Cylinder 11.5.4 Soot Formation Fundamentals 667 (7) 11.5.5 Soot Oxidation 674 (3) 11.5.6 Adsorption and Condensation 677 (1) 11.6 Exhaust Gas Treatment 678 (29) 11.6.1 Available Options 678 (3) 11.6.2 Catalyst Fundamentals 681 (6) 11.6.3 Catalytic Converters 687 (11) 11.6.4 Particulate Filters or Traps 698 (4) 11.6.5 Exhaust Treatment Systems 702 (5) Problems 707 (3) References 710 (5) Chapter 12 Engine Heat Transfer 715 (52) 12.1 Importance of Heat Transfer 715 (1) 12.2 Modes of Heat Transfer 716 (5) 12.2.1 Conduction 716 (1) 12.2.2 Convection 716 (1) 12.2.3 Radiation 717 (1) 12.2.4 Overall Heat-Transfer Process 718 (3) 12.3 Heat Transfer and Engine Energy Balance 721 (3) 12.4 Convective Heat Transfer 724 (7) 12.4.1 Dimensional Analysis 724 (1) 12.4.2 Correlations for Time-Averaged Heat 725 (1) Flux 12.4.3 Correlations for Instantaneous 726 (2) Spatial Average Coefficients 12.4.4 Correlations for Instantaneous Local 728 (2) Coefficients 12.4.5 Exhaust and Intake System Heat 730 (1) Transfer 12.5 Radiative Heat Transfer 731 (5) 12.5.1 Radiation from Gases 731 (1) 12.5.2 Flame Radiation 732 (4) 12.6 Measurements of Instantaneous 736 (8) Heat-Transfer Rates 12.6.1 Measurement Methods 736 (1) 12.6.2 Spark-Ignition Engine Measurements 737 (2) 12.6.3 Diesel Engine Measurements 739 (3) 12.6.4 Evaluation of Heat-Transfer 742 (2) Correlations 12.6.5 Boundary-Layer Behavior 744 (1) 12.7 Thermal Loading and Component 744 (17) Temperatures 12.7.1 Effect of Engine Variables 745 (9) 12.7.2 Component Temperature Distributions 754 (3) 12.7.3 Engine Warm-Up 757 (4) Problems 761 (1) References 762 (5) Chapter 13 Engine Friction and Lubrication 767 (54) 13.1 Background 767 (2) 13.2 Definitions 769 (2) 13.3 Friction Fundamentals 771 (3) 13.3.1 Lubricated Friction 771 (3) 13.3.2 Turbulent Dissipation 774 (1) 13.3.3 Total Friction 774 (1) 13.4 Measurement Methods 774 (2) 13.5 Engine Friction Data 776 (3) 13.5.1 SI Engines 776 (2) 13.5.2 Diesel Engines 778 (1) 13.6 Mechanical Friction Components 779 (18) 13.6.1 Motored Engine Breakdown Tests 779 (1) 13.6.2 Engine Lubrication System 780 (3) 13.6.3 Piston Assembly Friction and 783 (9) Lubrication 13.6.4 Crankshaft Friction 792 (3) 13.6.5 Valvetrain Friction 795 (2) 13.7 Pumping Friction 797 (5) 13.8 Accessory Power Requirements 802 (2) 13.9 Engine Friction Modeling 804 (1) 13.10 Oil Consumption 805 (8) 13.10.1 Oil Consumption Context 805 (3) 13.10.2 Oil Transport into the Cylinder 808 (1) 13.10.3 Oil Evaporation 809 (2) 13.10.4 Blowby and Oil Entrainment 811 (2) 13.11 Lubricants 813 (4) Problems 817 (1) References 818 (3) Chapter 14 Modeling Real Engine Flow and 821 (66) Combustion Processes 14.1 Purpose and Classification of Models 821 (1) 14.2 Governing Equations for an Open 822 (3) Thermodynamic System 14.2.1 Conservation of Mass 823 (1) 14.2.2 Conservation of Energy 823 (2) 14.3 Intake and Exhaust Flow Models 825 (8) 14.3.1 Background 825 (1) 14.3.2 Quasi-Steady Flow Models 825 (1) 14.3.3 Filling and Emptying Methods 826 (1) 14.3.4 Gas Dynamic Models 827 (6) 14.4 Thermodynamic-Based In-Cylinder Models 833 (30) 14.4.1 Background and Overall Model 833 (3) Structure 14.4.2 Spark-Ignition Engine Models 836 (11) 14.4.3 Direct-Injection Engine Models 847 (6) 14.4.4 Prechamber Engine Models 853 (2) 14.4.5 Multi-Cylinder and Complex Engine 855 (4) System Models 14.4.6 Second-Law Analysis of Engine 859 (4) Processes 14.5 Fluid-Mechanic-Based Multi-Dimensional 863 (20) Models 14.5.1 Basic Approach and Governing 863 (2) Equations 14.5.2 Turbulence Models 865 (3) 14.5.3 Numerical Methodology 868 (3) 14.5.4 Flow Field Predictions 871 (5) 14.5.5 Fuel Spray Modeling 876 (3) 14.5.6 Combustion Modeling 879 (4) References 883 (4) Chapter 15 Engine Operating Characteristics 887 (96) 15.1 Engine Design Objectives 887 (1) 15.2 Engine Performance 888 (11) 15.2.1 Basic Characteristics of SI and 888 (2) Diesel Engines 15.2.2 Characterizing Engine Performance 890 (2) 15.2.3 Torque, Power, and Mean Effective 892 (2) Pressure 15.2.4 Engine Performance Maps 894 (5) 15.3 Operating Variables That Affect SI 899 (21) Engine Performance, Efficiency, and Emissions 15.3.1 Spark Timing 899 (3) 15.3.2 Mixture Composition 902 (9) 15.3.3 Load and Speed 911 (5) 15.3.4 Compression Ratio 916 (4) 15.4 SI Engine Combustion System Design 920 (16) 15.4.1 Objectives and Options 920 (2) 15.4.2 Factors That Control Combustion 922 (4) 15.4.3 Factors That Control Performance 926 (3) 15.4.4 Chamber Octane Requirement 929 (4) 15.4.5 SI Engine Emissions 933 (1) 15.4.6 Optimization 934 (2) 15.5 Variables That Affect Diesel Engine 936 (10) Performance, Efficiency, and Emissions 15.5.1 Load and Speed 936 (4) 15.5.2 Combustion-System Design 940 (3) 15.5.3 Fuel Injection and EGR 943 (2) 15.5.4 Overall System Behavior 945 (1) 15.6 Two-Stroke Cycle Engines 946 (10) 15.6.1 Performance Parameters 946 (2) 15.6.2 Two-Stroke Gasoline SI Engines 948 (4) 15.6.3 Two-Stroke Cycle CI Engines 952 (4) 15.7 Noise, Vibration, and Harshness 956 (16) 15.7.1 Engine Noise 957 (8) 15.7.2 Reciprocating Mechanism Dynamics 965 (3) 15.7.3 Engine Balancing 968 (4) 15.8 Engine Performance and Fuels Summary 972 (1) Problems 973 (7) References 980 (3) Appendix A: Unit Conversion Factors 983 (4) Appendix B: Ideal Gas Relationships 987 (4) B.1 Ideal Gas Law 987 (1) B.2 The Mole 987 (1) B.3 Thermodynamic Properties 988 (1) B.4 Mixtures of Ideal Gases 989 (2) Appendix C: Equations for Fluid Flow through a 991 (3) Restriction C.1 Liquid Flow 991 (1) C.2 Gas Flow 992 (2) References 994 (1) Appendix D: Data on Working Fluids 995 (4) Index 999

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