

Preface

Combustion science and technology has made major strides in recent years with remarkable advances in analytical, computational, and diagnostic capabilities. High-speed computing along with improved fundamental understanding, and the development of modeling capabilities and detailed reaction mechanisms, have greatly enhanced our predictive capabilities. Concurrently, diagnostics has become significantly more accurate through the development of sophisticated instrumentation, particularly non-intrusive optical techniques, and is providing well-resolved spatial and temporal measurements of complex reacting flows in various combustion systems to support the modeling efforts. Consequently, CFD-based tools have now become ubiquitous in industry, and are increasingly being relied on for the improved design of existing systems and the validation of new design concepts and ideas. These developments have greatly helped in improving the performance of various combustion systems used in power generation, transportation, industrial, and residential applications. Advances in sensors and active control technology have further helped to improve system efficiencies, reduce emission levels, prolong equipment life, and mitigate catastrophic failures.

While the aforementioned advances in predictive and diagnostic capabilities have provided greatly improved combustion systems, energy and environmental issues are more important now than ever before due to rapidly increasing energy demand, diminishing fuel reserves, emission of toxins to the environment, and global warming. These issues continue to drive the fundamental and applied combustion research to achieve further gains in system performance and develop an integrated approach that incorporates low grade fuels and alternative energy sources for improving efficiency with cleaner environment. Moreover, global efforts must be made to develop common strategies and policies for a sustainable energy future.

An international workshop held at IIT Kanpur, India during January 2–5, 2014 provided a forum for discussions between eminent scientists and engineers from the USA, India, Japan, Thailand, Austria, who shared their views on various aspects of energy at this workshop. This research monograph is based on the topics covered at the workshop, and brings together a wealth of knowledge from world renowned experts on the latest development in selected technology areas with due focus on

fundamentals, applications, and advanced education. A common theme of the monograph is the sustainable energy utilization of conventional and renewable fuels. Chapters on conventional fuels focus on their utilization for power generation and transportation, while renewable fuels provide insights into their production and utilization. Research on using blends of fossil and renewable fuels in current power and propulsion systems is also presented. In addition, novel technology developments pertaining to efficient fuel reforming, distributed combustion, and micro-combustion are discussed.

Another major outcome of the workshop was the formation of the International Society for Energy, Environment and Sustainability (ISEES). The main objective of the Society is to organize Workshops/Symposia/Conferences/Lectures/Courses for widening and dissemination of knowledge in areas related to energy, combustion, sustainability, and environment. We hope that the Society will bring many novel contributions in the future that will be of great benefit to the international community. We also hope that continued efforts in the future from the international scientific community at future workshops in the field will contribute to a greener planet through sustainable energy and environment.

We would like to express our gratitude to the authors for submitting their work in a timely manner and revising it at short notice. We acknowledge the support received from various agencies and organizations for the successful conduct of the workshop, which include the National Science Foundation, USA, Office of Naval Research Global, Singapore (with special thanks to Dr. R. Kolar), MHRD TEQIP center at IIT Kanpur, and TSI and TESSCORN, who were industry partners for the event.

We hope that the book would be of great interest to the postgraduate students and researchers involved broadly in the area of energy and environmental sustainability, and more specifically to those interested in the areas of applied energy, alternative fuels, combustion, power systems, and engines.

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