Preface

Advanced Analysis of Turbulent Combustion

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Received: 24 April 2016 / Accepted: 25 April 2016 / Published online: 25 April 2016
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Turbulent combustion continues to represent one of the greatest challenges in the reacting fluid mechanics area. This is because of the non-linear interactions involved at this intersection of turbulence and chemistry, which give rise to a very wide range of trends and processes that are at present very difficult to predict from first principles. With the emergence of new technologies for power generation, aviation, and land transport, the ever-tightening pollution regulations, and the need to shift to alternative fuels, developing better theoretical methods for turbulent flames with finite rate kinetic effects is an absolute necessity.

In this volume, selected authors of high-quality papers from the 9th Mediterranean Combustion Symposium, which took place in Rhodes in June 2015, were invited to expand and develop further their papers and submit them for review as new contributions to a Special Issue on Turbulent Combustion. The papers cover the fundamentals - from experimental, Direct Numerical Simulation, and modelling perspectives - and also applications, such as the exploration of gas turbine flames. They include novel studies on the behaviour of flames propagating in a droplet mist; modelling with LES of premixed, stratified, non-premixed, and spray flames; and advanced experimental methods for imaging heat release.

A particular conclusion emerging from the collection of papers in this Special Issue is that the exploding increase of computational power, and hence the emergence of LES as the dominant simulation method for complex turbulent flows, has allowed more and more coupling with complex chemistry in turbulent reacting flow simulations, and this has resulted in the successful use of such tools to reveal features of the flame dynamics due to

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combustion-induced oscillations or local extinctions that were hitherto unassailable. Similarly, the development of diagnostic methods has resulted in new insights into complex phenomena in flames close to extinction.

The reader is encouraged to compare the different modelling approaches and to look out for the new physical phenomena described in the papers in this Special Issue. It is hoped that the wealth in the physics, but also the difficulty of describing them, will provide food for thought and ideas for further research.