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Advances in Computational Combustion: The UK Consortium on Turbulent Reacting Flows

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This Special Issue showcases a selection of fully reviewed articles, representative of the research activities pursued under the umbrella of the UK Consortium on Turbulent Reacting Flows (UKCTRF) in the period 2019–2023 (www.ukctrf.com). This research was undertaken within a national priority programme supported with large-scale HPC resources by the UK Engineering and Physical Sciences Research Council. Since its inception in 2014, the UKCTRF has achieved significant scientific and industrial impact through improved fundamental understanding and modelling of the aspects of turbulent reacting flows related to the effective usage of energy resources, development of reliable fire safety measures, and manipulation of the combustion processes to ensure environmental friendliness. The Consortium brought together 40 + experts across 19 UK institutions, experienced in using HPC on ARCHER2 (https://www.archer2.ac.uk/) to enable a concerted collaborative computational programme on turbulent reacting flows to reduce duplication and tackle challenges grander than individual attempts.

The Consortium focused on five major objectives: (i) utilize HPC resources to conduct world-leading turbulent reacting flow research involving Reynolds Averaged Navier–Stokes (RANS), Large Eddy Simulation (LES) and Direct Numerical Simulation (DNS); (ii) extract fundamental physical insights from simulations to develop high-fidelity modelling methodologies to study turbulent reacting flows relevant to power production, transportation and fire safety engineering; (iii) ensure a forward-looking software development strategy to develop computationally efficient algorithms, and effectively exploit current and future developments of HPC hardware; (iv) simulate multiphase, multiphysics turbulent reacting flows, flame-wall interaction and combustion at elevated pressures; and (v) analyze the combustion behaviour of biogas and low calorific fuels derived from coal gasification.

The papers included in this Special Issue report on (i) high-speed multiphase detonation waves, (ii) stratified mixture combustion (iii) premixed flame-wall interaction and (iv) environmentally friendly MILD combustion using Direct Numerical Simulations (DNS); Large Eddy Simulations (LES) of (v) premixed flame dynamics; (vi) thermoacoustic behaviour

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of H_2 enriched flames; and (vii) flame-assisted particle synthesis. All papers were thoroughly peer-reviewed by the UK and international experts on turbulent reacting flows following the usual practices of *Flow, Turbulence and Combustion*.

The guest editors hope that this Special Issue will be judged to be a valuable state-of-the-art addition to the subject of computational combustion science. We are grateful to the authors and reviewers for their contributions, which made this Special Issue possible.