

Computational Fluid Dynamics

An indispensable tool for in-depth understanding of flow and multi-physics systems

I am glad to write the foreword for this thematic issue of BARC Newsletter on “Computational Fluid Dynamics in Chemical Engineering, Material Science and Safety”. This is the second BARC Newsletter issue on this theme, the previous being November-December 2021 issue. The importance of computations and numerical simulations in all scientific and technological fields cannot be overemphasized. Particularly, Computational Fluid Dynamics (CFD) plays very important role in chemical engineering and related disciplines. While experiments are indispensable for validation purpose, CFD simulations help rationalize the number of experiments, virtually simulating some scenarios which, owing to being fraught with significant risk, cannot be studied experimentally. CFD simulation becomes a very useful practical tool if the phenomenon to be understood requires conducting highly controlled experiments. Also, the quantum of quantitative data and insights revealed by CFD simulations cannot be matched by experimental techniques. Having said this, it is worth mentioning that many problems such as the ones involving multiphase flows, phase change, breakage and coalescence of discrete phase, and multiphysics problems, pose significant challenges in CFD modelling. While, numerical tools and methodologies to solve such difficult problems are continuously being evolved, experimental validation remains an integral part of CFD modelling of such problems.

Increasing use of CFD by researchers is evident from the fact that the number of Scopus-indexed research articles having the word “CFD” in their title increased from up to 1500 during the period 1991-2000 to up to 7700 during the period 2001-2010. Further, the number of such articles increased to 18765 during the period 2011-2020. This whopping increase can partly be attributed to significant improvement in computational hardware and software which has made simulation of complex and large-scale problems easier. But the main reason is increasing reliance on CFD modelling by researchers.

This issue has 6 articles and 4 research highlights on CFD modelling. The first three articles are on applications of CFD in chemical engineering, the fourth article is on application of CFD in material science in which CFD has been used to analyse a system required for synthesis of CNT fiber. The last two articles highlight the use of CFD for safety related applications. Four research synopses provide a glimpse of the publication of the researchers and engineers working at BARC in the field of CFD.

I take this opportunity to thank Associate Editors for their time and efforts in preparing this issue, and the Newsletter Editorial Committee for suggesting the theme of the special issues on CFD in Chemical Engineering, Material Science and Safety. I would like to thank Dr. K.K. Singh, Head, Process Modelling and Demonstration Section, ChED, BARC for serving as one of the Associate Editors of these thematic issues. I would like to appreciate the efforts made by the authors for contributing articles to this special issue and the reviewers who have painstakingly reviewed the articles and gave suggestions to make them better. Special thanks to SIRD Editorial Team for their professional approach in preparing this issue of newsletter in a time-bound manner.

I hope this special issue will motivate young researchers and engineers to utilize CFD in pursuit of their research and development activities.

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