Numerical methods for incompressible or weakly compressible flows

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Several industrial CFD codes have been built over the past thirty years, in order to provide numerical solutions of some fluid-mechanics models. These codes are useful and even mandatory in many situations occurring in nuclear power plants : this is true for the support to the design of most components, for the prediction and optimization of standard flow configurations, and also for safety analysis. Most of these applications lie within the range of incompressible situations or weakly compressible low-Mach number flows. The keystone of almost all fluid flow models is basically the -closed- set of Navier-Stokes (NS) equations, though even more complex models may require the development of other specific algorithms. Of course, all fluid flow models involve highly non-linear patterns which render the construction of relevant algorithms rather intricate; moreover numerical methods differ, according to whether the flow is really incompressible or not. This has motivated a lot of research in applied and computational mathematics throughout the last four decades. It should be noted that several codes which are currently used to provide numerical approximations of solutions of NS partial differential equations rely on schemes which have proved to be efficient. However, there is a need for even more accurate and stable schemes in order to improve the quality of computational predictions, which is not yet satisfactory, in spite of the recent large increase of computer facilities. Thus the main objective of this mini-symposium is to provide an overview of some recent improvements and emerging ideas on these topics. The four invited speakers (Frédéric Coquel (CNRS), Stéphane Dellacherie (CEA), Jean-Luc Guermond (Texas AM University), Jean-Claude Latché (IRSN)) will emphasize new ways to compute incompressible or compressible situations.

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