

Editorial of CEMRACS 2021

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This special volume gathers research works that have been conducted during the 25th edition of the summer school CEMRACS (Centre d'Été Mathématique de Recherche Avancée en Calcul Scientifique), which took place at CIRM (Centre International de Rencontre Mathématique) in Luminy from July 19th to August 27th, 2021.

CEMRACS is an event initiated in 1996 by Yvon Maday and Frédéric Coquel. It takes place every year at CIRM in Luminy (Marseille, France) for six weeks. The aim is to bring together scientists from both the academic and industrial communities to exchange ideas about a modern and relevant scientific topic which is selected by the CIRM scientific committee. CEMRACS is composed of two parts. The first is a one-week summer school with lectures of leading scientists where the goal is to give an overview of the topic to non-expert participants. The remaining five weeks are dedicated to research projects proposed by academic scientists or industrial partners. Each project is carried out by a small group of students under the supervision of experienced researchers. Experience from the previous years has shown the significant positive impact of the CEMRACS, not only on the development of these short-term projects, but also on the interactions between mathematics, applied sciences and industry.

The event of 2021 focused on "Data Assimilation and Reduced Modeling for High Dimensional Problems". A significant challenge arising in increasingly many modern applications is how to blend complex mathematical models, often based on differential or integral equations, with the large and, possibly, noisy data sets which are now routinely available in many fields of engineering, science and technology. Growing efforts are made to develop a coherent mathematical framework where one of the main obstructions is the high dimensionality of the involved mathematical objects, which requires efficient sampling or optimization techniques for large-scale problems and, possibly, model order reduction strategies. The CEMRACS 2021 was devoted to this topic of data assimilation and model reduction in high-dimensional problems. It is by nature interdisciplinary, not only by the amount of the different mathematical skills that need to be invoked, but also by the detailed knowledge that each specific application requires.

The organization of the event started at the end of 2019, and went on during the covid pandemic that disrupted all activities between 2020, until the end of 2021. The special conditions made the organization very challenging: the series of lockdowns, and economic and social uncertainties of the period endangered several times the organization but luckily, the event could take place in the end, despite its late confirmation (only a few weeks before the scheduled time). The participants, especially PhD students and postdocs, were delighted to gather again after such a difficult period.

More details are available at <http://smai.emath.fr/cemracs/cemracs21/>