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Emerging Numerical Techniques in Inverse Problems and Data Assimilation

Scientific area: Computational Applied Mathematics

As computer architecture evolves, algorithms and software are required to develop and face the arising difficulties. Achieving better performance and efficiently using computational resources requires two orders of innovation: (1) at the abstract or theoretical level and (2) at the practical or algorithmic level. Innovation comes in the form of new and improved computational techniques, which can fully use the developments in many mathematical fields. The introduction of multi-level and randomized algorithms, parallelizable techniques, and structure-aware solvers are just a few examples.

In this mini-symposium, we intend to investigate how to realize such innovations in an Inverse Problems (IPs) and Data Assimilation (DA) context. We aim to cover diverse applications, including medicine, finance, material science, and climatology. We intend to provide space for the most diverse expertise in the field, from stochastics to functional analysis, from numerical algebra to data science. The scientific challenges we address in this mini-symposium include – but are not limited to – developments in

1. numerical linear (tensor) algebra for DA and IPs
2. machine learning and surrogate modeling techniques for DA and IPs
3. advanced numerical methods for partial differential equations for DA and IPs
4. Bayesian inference techniques for IPs
5. Bayesian and classical experimental design
6. particle-based filtering and smoothing
7. strong and weak variational data assimilation
8. randomized methods for DA and IPs
9. innovative parallelizable and scalable numerical methods for DA and Ips

Organizers:

Harshit Bansal, Department of Mathematics and Computer Science, Eindhoven University of Technology, h.bansal@tue.nl

Francesco Silva, Department of Mathematics and Computer Science, Eindhoven University of Technology