Methods for high-dimensional problems and the offline phase of reduced-order models

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Abstract. This talk deals with some aspects of the offline phase of reduced-order models (ROMs) and will be structured in three parts. In the first part we will establish a parallelism between certain parsimonious discretisation methods for high-dimensional problems and the reduced representation of solutions sets used in ROMs. In particular, several tensor methods will be described, and their interpretation provided. In the second part of the talk, we will discuss three contributions in which the solution set representation can be directly exploited in order to regularise or enable data assimilation problems. The first contribution is a unique continuation problem, in which velocity measurements in a subdomain will be exploited to reconstruct the flow (velocity and pressure) in the whole fluid domain. We will show how a linear subspace regularization mitigates the ill-posed character of the problem. The second work deals with the use of the Tensor Train format to propose a time dependent optimal recovery principle, with provable observability criterion. The third contribution proposes the use of autoencoders in order to regularise parameter estimation problems. This last contribution will provide the motivation to the third and last part of the talk, in which we will discuss possible non-linear constructive representations of solutions sets.