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Tensor product decomposition methods applied to complex flow data

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Low-rank multilevel approximation methods are an important tool in numerical analysis and in scientific computing. Those methods are often suited to attack high-dimensional problems successfully and allow very compact representations of large data sets. Specifically, hierarchical tensor product decomposition methods emerge as an promising approach for application to data that are concerned with cascade-of-scales problems as, e.g., in turbulent fluid dynamics. We focus on two particular objectives, that is representing turbulent data in an appropriate compact form and, secondly and as a long-term goal, finding self-similar vortex structures in multiscale problems. The question here is whether tensor product methods can support the development of improved understanding of the multiscale behavior and whether they are an improved starting point in the development of compact storage schemes for solutions of such problems relative to linear ansatz spaces. We present the reconstruction capabilities of a tensor decomposition based modeling approach tested against 3D turbulent channel flow data.