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abstract	Low-rank tensor methods for the approximate solution of second-order elliptic partial differential equations in high dimensions have recently attracted significant attention. A critical issue is to rigorously bound the error of such approximations, not with respect to a fixed finite dimensional discrete background problem, but with respect to the exact solution of the continuous problem. While the energy norm offers a natural error measure corresponding to the underlying operator considered as an isomorphism from the energy space onto its dual, this norm requires a careful treatment in its interplay with the tensor structure of the problem. In this paper we build on our previous work on energy norm-convergent subspace-based tensor schemes contriving, however, a modified formulation which now enforces convergence only in L_2. In order to still be able to exploit the mapping properties of elliptic operators, a crucial ingredient of our approach is the development and analysis of a suitable asymmetric preconditioning scheme. We provide estimates for the computational complexity of the resulting method in terms of the solution error and study the practical performance of the scheme in numerical experiments. In both regards, we find that controlling solution errors in this weaker norm leads to substantial simplifications and to a reduction of the actual numerical work required for a certain error tolerance.	This paper is concerned with the development and analysis of an iterative solver for high-dimensional second-order elliptic problems based on subspace-based low-rank tensor formats. Both the subspaces giving rise to low-rank approximations and corresponding sparse approximations of lower-dimensional tensor components are determined adaptively. A principal obstruction to a simultaneous control of rank growth and accuracy turns out to be the fact that the underlying elliptic operator is an isomorphism only between spaces that are not endowed with cross norms. Therefore, as central part of this scheme, we devise a method for preconditioning low-rank tensor representations of operators. Under standard assumptions on the data, we establish convergence to the solution of the continuous problem with a guaranteed error reduction. Moreover, for the case that the solution exhibits a certain low-rank structure and representation sparsity, we derive bounds on the computational complexity, including in particular bounds on the tensor ranks that can arise during the iteration. We emphasize that such assumptions on the solution do not enter in the formulation of the scheme, which in fact is shown to detect them automatically. Our findings are illustrated by numerical experiments that demonstrate the practical efficiency of the method in high spatial dimensions.		
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