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Title: Computing singular values of tensor sum via tensors

Abstract: The tensor sum $T \in \mathbb{R}^{\ell m n \times \ell m}$ is a matrix defined in the following:

$$T := I_n \otimes I_m \otimes A + I_n \otimes B \otimes I_\ell + C \otimes I_m \otimes I_\ell,$$

where $A \in \mathbb{R}^{\ell \times \ell}$, $B \in \mathbb{R}^{m \times m}$, and $C \in \mathbb{R}^{n \times n}$. This structure arises in the discretization of three-dimensional partial differential equations with constant coefficients using finite difference methods. When $\ell = m = n$, the resulting matrix T becomes an $n^3 \times n^3$ matrix. Computing its singular values by a direct method is computationally expensive in terms of memory. In this talk, we present an iterative algorithm via tensors, which are multi-dimensional arrays, to efficiently compute the singular values of T while reducing memory usage.