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Analysis and compression of six-dimensional gyrokinetic datasets using higher order singular value decomposition D. DEL-CASTILLO-NEGRETE, Oak Ridge National Laboratory, D. HATCH, Max-Planck-Institut fur Plasmaphysik, Garching, Germany, P. TERRY, University of Wisconsin, Madison —
Higher order singular value decomposition (HOSVD) is explored as a tool for analyzing and compressing gyrokinetic data. An efficient numerical implementation of an HOSVD algorithm is described. HOSVD is used to analyze the full six-dimensional (three spatial, two velocity space, and time dimensions) gyrocenter distribution function from gyrokinetic simulations of ion temperature gradient, electron temperature gradient, and trapped electron mode driven turbulence. The HOSVD singular values for the velocity space coordinates decay very rapidly, indicating that only a few structures in velocity space can capture the most important dynamics. In almost all of the cases studied, HOSVD extracts velocity space structures that are very similar to orthogonal polynomials. HOSVD is also used to compress gyrokinetic datasets, an application in which it is shown to significantly outperform the more commonly used singular value decomposition. It is shown that the effectiveness of the HOSVD compression improves as the dimensionality of the dataset increases.

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