Abstract Submitted
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A Multi-Staged Biorthogonal Decomposition to Identify Spatial Mode Structures[1] M.H. ROSEN, New York University, R.N. CHANDRA, Y. WEI, I.G. STEWART, J.W. BROOKS, J.P. LEVESQUE, M.E. MAUEL, Columbia University — Mode feedback control and disruption prediction of tokamaks rely on predefined spatial mode structures to rapidly process data. Here, a new algorithm is introduced for finding experimentally defined modes as an extension of biorthogonal decomposition (BD). The first stage uses a BD to find spatial modes in multiple individual data sets. These spatial modes are used to form a mode-shot matrix, where each column is a spatial mode found in the first stage. The second stage uses a BD on the mode-shot matrix to find the orthonormal vectors which best represent these spatial modes. This process finds the best representation for the spatial mode structures of many shots. This algorithm is tested using data from magnetic sensors and extreme ultraviolet diode arrays on the HBT-EP tokamak to study disruptions. All considered shots are selected using criteria that they disrupt in similar ways; they are well centered in the tokamak, have a high loop voltage, are relatively long-lived, and do not have minor disruptions. The results confirm the current model of disruptions using a data-driven method, which made no assumptions about the underlying physics. Other tokamaks would benefit from using this algorithm to define mode structures used for feedback control and disruption prediction.

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