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Parallelized multi-degrees-of-freedom cell mapping method

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ABSTRACT

Long-term global analysis of lower-dimensional systems can be performed by in a computationally efficient manner by using cell mapping methods. Scaling limitations associated with higher order systems can be addressed by using the multiple degree-of-freedom cell mapping (MDCM) method. However, the MDCM algorithm consists of a number of sequential operations which limits its ability to utilize the parallel processing capabilities of modern computers. A parallelized multiple degree-of-freedom cell mapping (PMDCM) method is introduced here to address this limitation. By restructuring the MDCM algorithm to enable parallel operations, the efficiency of the algorithm is significantly enhanced. The details of the PMDCM algorithm are presented and performance is compared to the MDCM method and baseline obtained by using the grid-of-starts method. By running the PMDCM method on a workstation with a quad-core processor and by parallelizing 100 numerical integration operations, the total computation time is decreased by 93% from the time required of the MDCM method. Parallelizing the integration operations also reduces the error which can accumulate when by using the sequential operations of the MDCM method.