Code optimizations in the BSC Advanced Computing Hub: Implementation of matrix compression for the coupling of JOREK to the 3D realistic conducting wall structures

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JOREK [1] is one the most advanced non-linear simulation codes for studying MHD instabilities that can occur in magnetically confined fusion plasmas as well as their control. A free-boundary and resistive wall extension was introduced via coupling to the STARWALL [2] and very recently the CARIDDI [3] codes, both able to provide dense matrices describing the electromagnetic interactions between plasma and conducting structures. MPI/OpenMP hybrid parallelization is exploited for the coupling [4]. Due to the state-of-the-art limitations of the available memory of modern days CPU, the reachable resolution in such simulations is not sufficient to describe all the details of the wall structures of the ITER tokamak. In the present work, the Singular Value Decomposition provided by routines from the ScaLAPACK library [5] has been successfully applied to reduce the memory required by some response matrices. This contribution will describe the enhancements achieved in the JOREK code at the CIEMAT-BSC ACH. We will show results from preliminary tests of Vertical Displacement Events, which provide hints on key steps to be undertaken for improvements, up to simulations of Tearing Mode instabilities, for which significant memory compression has been reached.

References

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