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Load Balancing and Scalability with the Code Coupler JMxx

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JMxx is a coupling framework designed for the aero-thermal simulation of complex, heterogeneous systems with an arbitrary number of fluid and solid domains. In JMxx the computational resources are distributed among groups of *solver processes* and groups of *coupler processes*. The computing sessions which have to be coupled are executed concurrently on the solver processes, whereas the coupler processes are specific resources dedicated to each interface present in the system. All coupler processes pertaining to a specific interface form a Coupler Unit. A Coupler Unit can be seen as an independent server through which the data flow between two connected domains occurs. This architecture provides great flexibility, and allows scalable options for the overhead associated with searching algorithms, interpolation and communications between solvers.

In this paper, we analyse the parallel performance of JMxx for test-cases relevant to turbomachinery applications, involving sliding-planes between rotor and stator zones, overset interfaces defined through Chimera hole-cutting techniques, and hybrid LES/RANS computations based on the dual-hybrid mesh approach of Xiao and Jenny [2].

The modular structure of JMxx enables the use of simple strategies to achieve inter-code load balancing, while keeping the interpolation and communications cost evenly distributed among the coupler processes. This results in good scaling performance measured up to several thousand cores.

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