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A RUNTIME-BASED DYNAMIC MESH PARTITIONING APPROACH

G. Baldan*[1], R. Borrell[2], J. Jägersküpper[1]

[1] Institute of Aerodynamics and Flow Technology
German Aerospace Center - DLR
38108 Braunschweig, Germany
giacomo.baldan@dlr.de
[2] Barcelona Supercomputing Center
08034 Barcelona, Spain

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Large-scale parallel numerical simulations are fundamental for the understanding of a wide variety of aeronautical problems. The increasing requirements of achieving high-fidelity results are linked to the growing resolution of computational domains. Mesh decomposition is applied to make use of parallel hardware. In particular, when using a massively parallel architecture, the partitioning algorithm has to be robust as well as efficient.
We focus on the integration of space-filling curve (SFC) based partitioning software, such as GeMPa [1], in the flow solver CODA, which is commonly developed by ONERA, DLR, Airbus and bases upon the infrastructure of the flexible unstructured CFD software "Flucs" [2]. A strategy for dynamic-mesh partitioning based on runtime measurements is presented. This approach mitigates the limitations imposed by a-priori estimated weights. Indeed, assigning optimal weights to each element is difficult when using complex algorithms. For instance, if adaptive techniques are adopted, such as hp-adaptive finite-element methods, multiple non-uniform grids may be present. In addition, partitioning weights are usually influenced by the underlying architecture. Compared to standard graph-based partitioning approaches, SFC-based ones are more scalable as they do not require the graph extraction from the mesh. Reducing partitioning time is crucial when using a dynamic approach, since the partitioning is performed multiple times.
The performances of the presented approach are tested on a case of aeronautical interest. In particular, the load imbalance among processes is evaluated and compared with a static graph-partitioning approach. In addition, we analyze how the number of processes to be used influences the partitioning quality.

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