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MULTI-MODEL STRUCTURAL COUPLING IN NON-LINEAR STATICS: A ROBUSTNESS STUDY

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Innovation has always been at the core of the aerospace industry. To attain the latest goals of passenger flights, a full digitalization of the aircraft has been systematized across multiple disciplines (such as structural mechanics, electro-magnetism, fluids dynamics, vibro-acoustics and multi-body dynamics) and multiple levels of abstraction (aircraft / component / element / detail). A multi-model interdisciplinary strategy is therefore necessary to put in place accurate and robust simulations to support initial design, verifications, validations, and maintenance.
In the field of structural mechanics, aerospace engineers often employ a hierarchical top-down simulation approach (also known as 1-way sub-modeling approach) from global coarse models to lower level refined local models, unidirectionally bridging the multiple abstraction levels, projecting displacement boundary conditions to lower level models out of global coarse results. For such approach is always inexact due to the dependency between global and local solutions, an iterative scheme in which the global simulation is corrected and repeated (also known as 2-way sub-modeling approach) is required to meet accuracy targets in the special cases where the discrepancy between local reaction forces and global free-diagram forces is not negligible. An extensive review of the global-local coupling and its convergence acceleration can be found in [1], whereas its non-intrusive advantage (i.e. the capability to be implemented within existing commercial software without need for refurbishment of global models) has been analysed, for instance, in [2] and [3]. With the present works, the authors aim to study the convergence of the global-local iterative scheme, implemented into Abaqus, applied to nonlinear statics simulation, including the worst case scenarios in which the more refined local model exhibits a stiffer behaviour than the global coarser counterpart.

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