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P3.141 F4E Load Transfer Procedure among Finite Element Models different in Topology or in Discretization

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In magnetic confinement fusion ITER represents the most challenging projects conceived ever. The assessment of ITER structural behavior is not trivial since it requires the application of loads coming from different types of analysis (electromagnetic (EMAG), thermal, dynamic, etc.), which are usually run using different software and Finite Element (FE) models, onto mechanical (MECH) models representing the system itself. The load interpolation between meshes dissimilar in discretization or in topology needs to be carefully performed in order to avoid that such an incompatibility could affect the global or local mechanical equilibrium of the system, not correctly preserving the spatial distribution of forces and related moments.

In this paper, a methodology developed in Fusion for Energy (F4E) for interpolating mechanical loads both between compatible (i.e. from solid to solid models different in discretization) and incompatible (e.g. from solid models to shell/beam models) FE models will be described in detail. This novel procedure is able of transferring a force vector field (i.e. Lorentz forces) from a three-dimensional solid mesh (i.e. the EMAG model) onto a target mesh (i.e. the MECH FE model), being it either three-dimensional solid or simplified beam/shell model.
This interpolating procedure is developed with the aim of preserving both the global and the local mechanical equilibrium of the system in terms of resultant of forces and overturning moments.
The quality assessment of this procedure is based on the comparison between the global force and moment resultants of the source and the transferred load field. A few examples and their related results will be discussed in support of this methodology. Furthermore, an exhaustive application of this procedure can be found in the paper [1].

References:
[1] Edoardo Pompa, Gabriele D'Amico, Pietro Testoni, Didier Combescure, First Wall #6 mechanical assessment using the F4E Load Transfer Procedure for electromagnetic loads distribution.

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