Università degli Studi di Pavia
Computational Mechanics & Advanced Materials Group

UNIVERSITÀ DI PAVIA
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SHORT COURSE

A Novel Method of FEM Modeling and Solution without Assembly: Can It Be Possible?

Part I: Theory and Formulation

A new formulation for the displacement-only partitioned equations of motion for linear structures is presented, which employs: the partitioned displacement and acceleration and applied force (d, $\ddot{d}$, f); the partitioned block diagonal mass and stiffness matrices (M, K); and, the coupling projector (Pd), yielding the partitioned coupled equations of motion:

$$M\,\ddot{d} = \mathrm{Pd}(f - K\,d) \quad (1)$$

The preceding DP (Displacement-only Partitioned) equations of motion (1) possess two key features. The nonzero frequencies and the static displacements ($\ddot{d} = 0$) are the same as those obtained by the corresponding assembled FEM equations. The key element of the proposed DP equations is the coupling projector (Pd) which can be constructed with the partitioned mass matrix (M) the Boolean matrix that extracts the partition boundary degrees of freedom (B) and the assembly matrix (Lg) relating the assembled displacements (dg) to the partitioned displacements (d) via d = Lg d.

In companion Part II, we present applications of the proposed formulation: unconditionally stable explicit-implicit transient analysis, static parallel analysis in an iterative solution mode; reduced-order modeling (component mode synthesis); localized damage identification which can pinpoint damage locations.

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05 Ottobre 2023
Dalle 11.00 alle 12.00
Aula MS1, DICAr