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The coupling of solids and shells by conjugate approximations

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ABSTRACT

In order to capture details of structural deformations efficiently, it may be necessary to use finite element models which combine three-dimensional discretizations of solids with approximations of two-dimensional shell models. If the physical coupling of the models of different dimensionality is strong, the most robust approach to solve the resulting equations is to apply a tight coupling, so that all equations are solved simultaneously. This requires additional flexibility of finite element software, together with the ability to generate consistent constraint equations. We shall consider these aspects and show how the idea of conjugate approximations, which was put forward already in the early 1970's, enters as a means to formulate a consistent fully coupled model.

Keywords: finite element, mixed-dimensional coupling, tight coupling, reciprocal basis.