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Analysis of a Structural Detail Using a Two-Scale Approach

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The aim of this work is to solve mechanical problems on a large structure containing a detail. Contrary to classical methods of resolution which need significant refinement of the mesh of the structure to able to define precisely the detail, our approach suggest another way to solve this kind of problem. Our method is based on a seperation of scales. Therefore, there are two distinct problems: a detail problem and a modified structural problem. We start by solving the detail problem. We consider the detail embedded in an infinite media with zero displacement at infinity considering the detail has no impact at an infinite distance. The purpose of this resolution is to obtain local elementary solutions. Afterwards, the modified structural problem is treated. Two approaches are studied: an “extended” homogenization and an enrichment strategy. In the first one, the regular element stiffness are replaced by the homogenized element stiffness for those elements close to the detail. The stiffness matrix is deduced to the previous elementary solutions. In the second approach, the approximation of the elements close to the detail is enriched using addition of degrees of freedom and a partition of unity enrichment strategy. After all, the localisation is executed. Thanks to the previous enriched solution, we can define the deformation field close to the detail.

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