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3D MLS-Based Variable-Node Elements for Easy Meshing

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ABSTRACT

In recent years, MLS-based variable-node elements, including finite crack elements, were developed for non-matching problems [1-3]. Moreover, these elements were refined [4] and partially expanded to 3D problems [5]. The main features of MLS-based variable-node elements are flexibility and simplicity. MLS-based variable-node elements, as depicted in the terms, are constructed by moving least-squares approximation and have arbitrary "n" nodes we need. Even though, these elements satisfy the Kronecker delta condition at the boundary of element as conventional finite elements do. Moreover, these elements could be mapped from master elements and use the framework of the conventional finite element analysis procedure with no additional effort. Therefore, we could easily implement MLS-based variable-node elements to deal with non-matching mesh interface or crack propagation as depicted in Fig. 1.

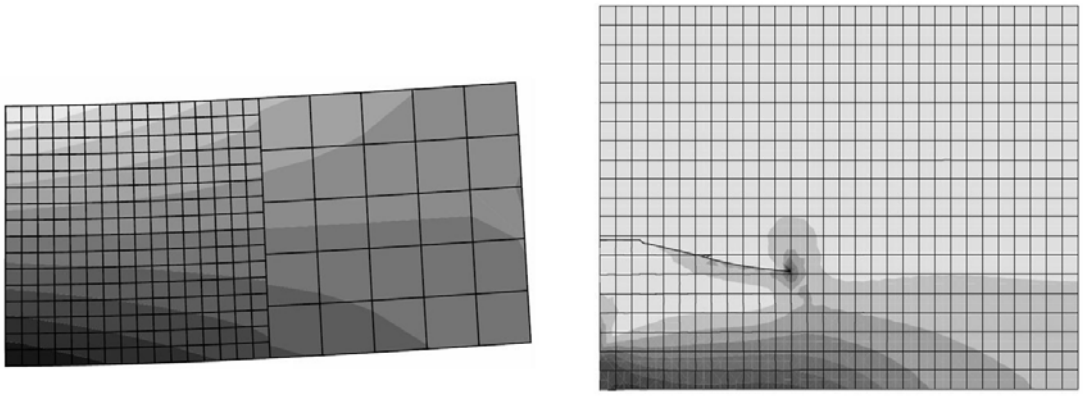

Fig. 1 Contour plots of von Mises stress of (a) bending problem with non-matching mesh interface using MLS-based variable-node elements [1] and (b) crack propagation problem using finite crack elements derived from MLS-based variable-node elements [3].

In this study, we would develop 3D MLS-based variable-node elements for easy meshing. These elements should be derived from 2D MLS-based variable-node elements and would be utilized as key elements of easy meshing technique we would propose. Using developed 3D MLS-based variable-node elements, we would demonstrate several examples having complex configuration compared with conventional meshing technique. Moreover, we would compare with the stress results of our model and conventional one.

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