3D FEA FOR DISCONTINUOUS MAPPED HEXA8 MESH WITH ELEMENT-WISE SURFACE-MESH BASED SERENIPITY BLENDING FUNCTION

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There is a big issue to generate hexahedral FE model, since a process to divide the whole domain into several simple-shaped sub-domains is required before generating a continuous mesh with mapped mesh generators. In general, it is nearly impossible to set up proper division numbers interactively to keep mesh connectivity between sub-domains on a complicated arbitrary-shaped domain. If mesh continuity between sub-domains is not required in an analysis, this complicated process can be omitted. Usually NLC is applied to set up constraints to keep the continuity between two discontinuous individually meshed sub-domains with different division numbers, however this approach results in an unacceptable rigid deformation in most cases, due to the characteristic on the system of constraint equations. Although EFGM might accept discontinuous meshes, which only requires nodal information, it is difficult to choose a reasonable influenced domain in MLS with non-uniformly distributed nodes in discontinuous FE models in reality. The blending shape function with partitioned numerical integration was originally proposed in QUAD[1] and HEXA[2] element, but this approach is originally limited only to 1-irregular mesh type. The extension of this function is a promising way, because there are no parameter dependencies. To apply this idea to arbitrary HEXA elements in the discontinuous mesh parts, element-wise local surface meshing is needed to construct serendipity blending HEXA element. Here a new finite element shape function for discontinuous mapped HEXA8 mesh with element-wise surface-mesh based serendipity hierarchical blending function is proposed to solve the problem mentioned above.

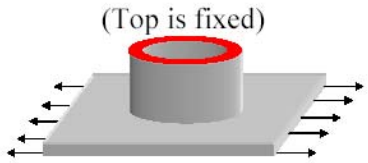
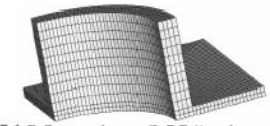


Fig. 1 Pulled plate with a pipe


(5125 nodes, 3520 elements)

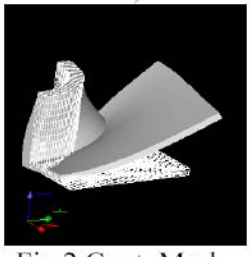
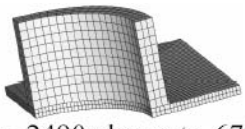


Fig.2 Cont. Mesh


(4188 nodes, 2490 elements, 677 constraints)

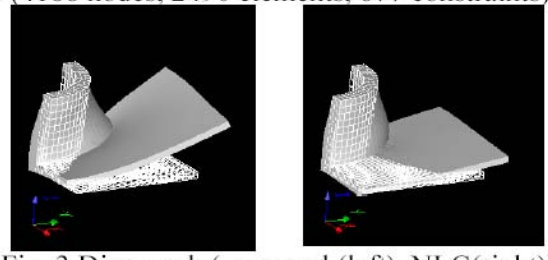


Fig. 3 Disc.mesh (proposed (left), NLC(right))

References

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[2] D.J. Morton, J.M. Tyler and J.R.Dorroh, "A New 3D Finite Element for Adaptive h-Refinement in 1-Irregular Meshes", *International Journal for Numerical Methods in Engineering*, v.38, p.3989-4008, 1995

[3] A. Tezuka, "Arbitrary h-adaptive FEM with Improved Blending Functions", *Proceedings of CJK-OSM 2*, p.815-820, 2002