Abstract

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Incremental approach for radial basis functions mesh deformation with greedy algorithm

Mesh Deformation is an important element of any fluid-structure interaction simulation. In this article, a new methodology is presented for the deformation of volume meshes using incremental radial basis function (RBF) based interpolation. A greedy algorithm is used to Select a small subset of the surface nodes iteratively. Two incremental approaches are used to solve the RBF system of equations: 1) block matrix inversion based approach and 2) modified LU decomposition approach. The use of incremental approach decreased the computational complexity of solving the system of equations within each greedy algorithm's iteration from to . Results are presented from an accuracy study using specified deformations on a 2D surface. Mesh deformations for bending and twisting of a 3D rectangular super critical wing have been demonstrated. Outcomes showed the incremental approaches reduce the CPU time up to 67% as compared to a traditional RBF matrix solver. Finally, the proposed mesh deformation approach was integrated within a fluid-structure interaction solver for investigating a flow induced cantilever beam vibration.