Atluri, S. N.; **Han, Z. D.**; **Rajendran, A. M.**

A new implementation of the meshless finite volume method, through the MLPG "mixed" approach. (English) Zbl 1151.74424

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Summary: The Meshless Finite Volume Method (MFVM) is developed for solving elasto-static problems, through a new Meshless Local Petrov-Galerkin (MLPG) "mixed" approach. In this MLPG mixed approach, both the strains as well as displacements are interpolated, at randomly distributed points in the domain, through local meshless Interpolation schemes such as the moving least squares (MLS) or radial basis functions (RBF). The nodal values of strains are expressed in terms of the independently interpolated nodal values of displacements, by simply enforcing the strain-displacement relationships directly by collocation at the nodal points. The MLPG local weak form is then written for the equilibrium equations over the local sub-domains, by using the nodal strains as the independent variables. By taking the Heaviside function as the test function, the local domain integration is avoided; this leads to a meshless finite volume method, which is a counterpart to the mesh-based finite volume method that is popular in computational fluid dynamics. The present approach eliminates the expensive process of directly differentiating the MLS interpolations for displacements in the entire domain, to find the strains, especially in 3D cases. Numerical examples are included to demonstrate the advantages of the present methods: (i) lower-order polynomial basis can be used in the MLS interpolations; (ii) smaller support sizes can be used in the MLPG approach; and (iii) higher accuracies and computational efficiencies are obtained.

MSC:

74S10	Finite volume methods applied to problems in solid mechanics
74B05	Classical linear elasticity
74-04	Software, source code, etc. for problems pertaining to mechanics of deformable solids

Keywords:

meshless local Petrov-Galerkin approach (MLPG); finite volume methods; mixed methods; radial basis functions (RBF); moving least squares (MLS)