An Optimization Study of Radial Point Interpolation Meshfree Method for Various Applications

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Abstract

As part of the project on modeling delamination at the yarn-matrix interface of woven SiC/SiC composite, a RPIM meshfree frictionless contact code was built from scratch. At the first stage of the software design 2D and 3D models for elastic small-strain single body problems were created. In the verification and convergence process, examples of a cube under uniform compression and a cantilever beam under a bending force were used to optimize the main parameters involved. The radial basis function method used for this study was the multi-quadric and its inverse, which contain two shape parameters of α_c and q to optimize. In addition to α_c and q, the use of polynomial terms for computing the shape functions, the number of the field nodes in the support domain and the total number of field nodes in the problem domain were studied. It was found that using the first order polynomial terms in the shape function calculations leads to an overall error reduction but it also changes the terms of the optimization process. Because while the optimized values of α_c and q for the beam bending example matched with and without polynomial terms, for the cube under compression a different optimization was obtained, which meant there was no generalized optimum value for all the applications. In order to investigate this further few other examples such as pressure inside a thick pipe, sphere under compressive force and few more are being studied so a more generalized understanding of the optimization can be reached. This optimization will further be tested in the context of frictionless contact, which can then be applied to modeling the woven composite.

Keywords: radial point interpolation, mesh free, multi-quadric, optimization