An ES-FEM Mechanics Analysis method using the experimental forces for the Conical Pick

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Abstract

This Paper presents an edge-based smoothed finite element method (ES-FEM) and an algorithm of creating the smoothing domain for revealing the stress and strain distributions to find a method that could effectively improve their wear resistance. First, the conical pick forces are obtained from the laboratory tests, using a full-scale rotary cutting machine. Secondly, the physical domain is discretized using linear triangular elements which can be generated easily for complicated geometries, and then the smoothing domains are constructed based on edges of these elements. In order to create the smoothing domains of ES-FEM, an algorithm is given for establishing connection between nodes, edges, faces and elements. Each smoothing domain is bounded by a set of enclosed line segments, besides, some connectivity list of conical pick are given. To show the effectiveness and accuracy of the ES-FEM, the strain energy, the displacement，the stress and error comparison of ES-FEM with other methods are presented. It can be concluded that ES-FEM is a higher convergence in energy norm and better accuracy than FEM using the same mesh from the comparison results.

Keywords: Finite element analysis, S-FEM, Smoothing domain, Conical Pick, Cutting force