A RELAY MODEL FOR MESHLESS APPROXIMATIONS IN DOMAINS WITH IRREGULAR BOUNDARIES

A relay model is proposed to provide a general solution for meshless approximations in domains with irregular boundaries. The essence of this model is the formulation of a hierarchical network of relay points within an influence domain, via which the influence from the source node is transmitted to the blocked areas. It resembles the network of relay stations in a radio communication system except that the influence (it is "signal" in radio communication) is relayed without being amplified at the relay points. In the model, a relay point is defined as a boundary node with only one boundary segment visible to the source node or the upper relay point. Relay points are ranked with their rank orders assigned according to their relationship with the source node. Each relay point governs a relay region whose profile is defined using a circle involute curve. As with relay points, relay regions are also ranked with their orders inheriting from their respective governing relay points. To compute nodal weights, an equivalent distance is defined for points that have no straight connection with the source node in order to measure the weight parameter in a weight function. The equivalent distance accounts for the details of boundaries, which is different from the physical distance.

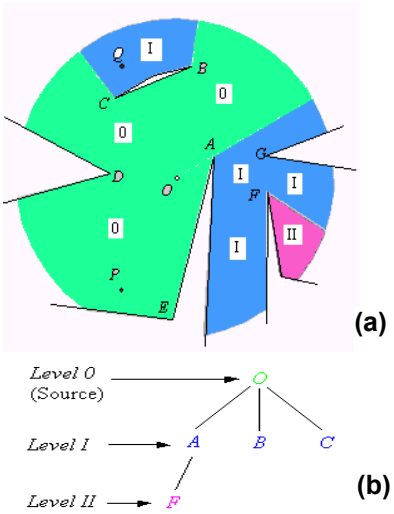

Fig. 1 A relay model constructed within an influence domain containing numerous irregular boundary fragments. (a) the relay regions; (b) the network of relay points.

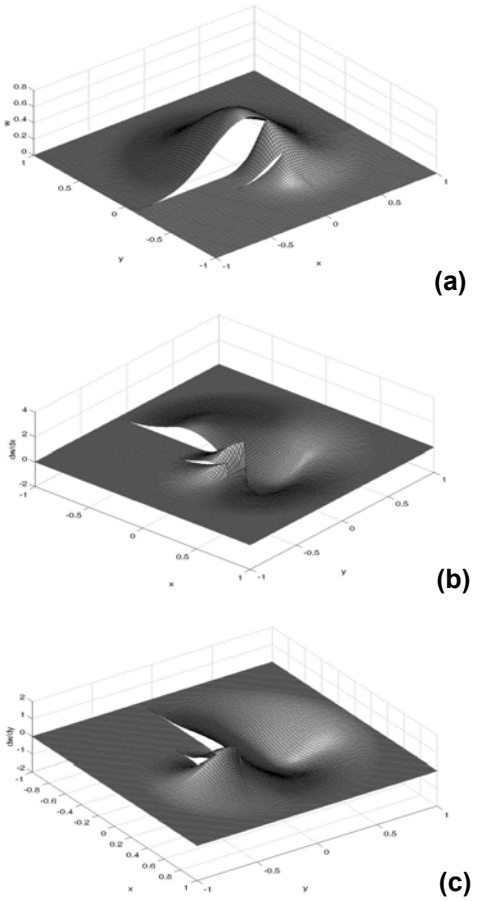

Fig. 2 Surface plots of the cubic spline weight function by the relay model. (a) w; (b) $w_{,x}$; and (c) $w_{,y}$.

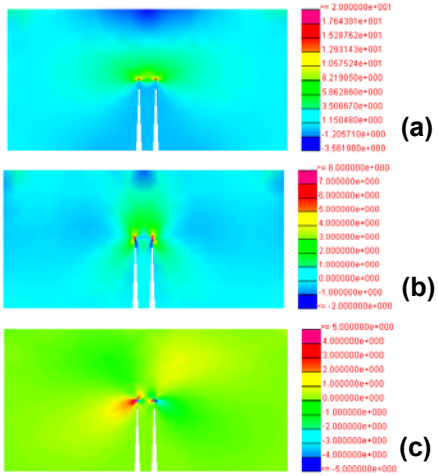

Fig. 3 Sample computation to test the relay model. The interference between two close cracks within a rectangular plate. (a) σ_{xx}; (b) σ_{yy}; and (c) σ_{xy}.