

## **Towards Automation in Numerical Modelling:**

### **The Scaled Boundary Polygon Element and Quadtree Mesh**

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We present a general  $n$ -sided-polygon element and its combination with the quadtree meshing technique. This development potentially leads to the automation of numerical modelling and at the same time improves the efficiency of finite element analysis. The  $n$ -sided-polygon element is based on the scaled boundary finite element method and has the following attractive features: (1) *High-order elements* are constructed straightforwardly; (2) *No asymptotic enrichment* or other special technique is required to model strain/stress singularities and discontinuities; (3) It offers *great flexibility in mesh generation*, local remeshing and mesh density transition as occurring in adaptive analyses and moving boundary problems; (4) *No special integration techniques* are required. The  $n$ -sided-polygon element is ideally suited to quadtree meshes as *no hanging nodes* exist and the amount of element analysis is significantly reduced due to the geometrical similarity of the elements. The accuracy, efficiency and robustness are demonstrated with numerical examples. Potential applications are discussed.

**Keywords:** Polygon element, scaled boundary finite element method, quadtree mesh, high-order element.