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FE ADAPTIVE ANALYSIS OF MULTI-REGIONS MODELS

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Abstract. This work presents a methodology for adaptive generation of 3D finite element meshes using geometric modeling with multi-regions and parametric surfaces, considering a geometric model described by curves, surfaces, and volumes. The adaptive strategy adopted in this methodology is based on independent refinements of these entities. From an initial model, new sizes of elements obtained from numerical error analysis and from geometric restrictions are stored in a global background structure, a recursive spatial composition represented by an octree. Based on this background structure, the model curves are initially refined using a binary partition algorithm. The discretization of curves is then used as input for the refinement of adjacent surfaces. The surface discretization also employs the background octree-based refinement, which is coupled to an advancing front technique for the generation of an unstructured triangulation. Surface meshes are finally used as input for the refinement of adjacent volumetric domains. In all stages of the adaptive strategy, the refinement of curves, surface meshes, and solid meshes is based on estimated numerical errors associated with the mesh of the previous step in the adaptive process. In addition, curve and surface refinement takes into account curvature information. An example is presented in order to validate the methodology proposed in this work.