Red refinements of simplices into congruent subsimplices

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Abstract: We show that in dimensions higher than two, the popular “red refinement” technique, commonly used for simplicial mesh refinements and adaptivity in the finite element analysis and practice, never yields subsimplices which are all even for an acute father element acute as opposed to the two-dimensional case. In the three-dimensional case we prove that there exists only one tetrahedron that can be partitioned by red refinement into eight congruent subtetrahedra that are all similar to the original one.

Keywords: Sommerville tetrahedron, red refinement, higher-dimensional simplex, Freudenthal partition, finite element method.

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