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Similarity classes generated by the Octasection method applied to the triangulation of the 3D unit cube into six tetrahedra

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ABSTRACT

In three dimensions the two most natural ways to subdivide a tetrahedron into subtetrahedra are bisection and octasection. Octasection methods simultaneously create eight descendants for each tetrahedron. After cutting off four subtetrahedra at the corners, the remaining octahedron can be subdivided further in three different ways corresponding to the three possible diagonals of the parellelograms of the interior of the octahedron, generating four more subtetrahedra.

This interior diagonal has to be chosen carefully in order to preserve the non-degenaration of the elements, and also to satisfy the stability condition [3]. In general, only the four subtetrahedra located at the corners are similar to their father, but not the interior ones. Note that the eight subtetrahedra are of equal volume.

We consider here the octasection method of the triangulation of the 3D unit cube into six tetrahedra using only the eight given vertices [1, 2]. Besides, this method may be implemented to convert a mesh from hexahedral to tetrahedral elements.

We study the number of similarity classes generated and the non-degenerancy of the triangulation of the 3D unit cube by the octasection method, as well as, how regular or stable can be the mesh obtained and the quality of the subtetrahedra generated.

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