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Delaunay Triangulations Efficiency for Conduction-Convection Problems

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Abstract : This work is a comparative study on the effect of Delaunay triangulation algorithms on discretization error for conduction-convection conservation problems. A structured triangulation and many unstructured Delaunay triangulations using three popular algorithms for node placement strategies are used. The numerical method employed is the vertex-centered finite volume method. It is found that when the computational domain can be meshed using a structured triangulation, the discretization error is lower for structured triangulations compared to unstructured ones for only low Peclet number values, i.e. when conduction is dominant. However, as the Peclet number is increased and convection becomes more significant, the unstructured triangulations reduce the discretization error. Also, no statistical correlation between triangulation angle extremums and the discretization error is found using 200 samples of randomly generated Delaunay and non-Delaunay triangulations. Thus, the angle extremums cannot be an indicator of the discretization error on their own and need to be combined with other triangulation quality measures, which is the subject of further studies.

Keywords : conduction-convection problems, Delaunay triangulation, discretization error, finite volume method
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