

26th International Meshing Roundtable

A deviation-based vertex reordering technique for mesh quality improvement

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Abstract

In this paper, we devised a vertex reordering technique to exploit the inequality in quality of mesh elements so that poor quality elements are improved at the cost of high-quality elements. We reorder vertices based on how likely it is to improve the quality of adjacent elements based on the gradient of the element quality with respect to the vertex location. The technique is heuristic, and it is based on the theory of nonsmooth optimization.

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Peer-review under responsibility of the scientific committee of the 26th International Meshing Roundtable.

Keywords: Mesh optimization; Vertex reordering ; Mesh quality improvement

1. Introduction

In the local variant of mesh quality improvement algorithms, each vertex is moved at a time, thereby improving the quality of the elements immediately surrounding the vertex. The improvement seen in such methods also depend on the order in which the vertices are processed. Although there have been a few studies on the reordering mesh vertices such that faster and more efficient quality improvement occurs [1,2], there has been no theoretical basis for such reordering. In this paper, we propose a deviation-based vertex reordering technique for mesh quality improvement based on our recent work [3]. We devised a vertex reordering technique such that the propagation of inequality in quality of mesh elements is accelerated.

2. Numerical results

We tested our vertex reordering methods on several test meshes. Numerical results show that the proposed vertex reordering methods are able to improve the worst element quality for all test meshes. In particular, for one test mesh, the worst element quality was improved by 7.2% after the technique was used.

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Acknowledgements

The authors were supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT & Future Planning (NRF-2017R1C1B1007080).

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