

Insertion Of Anthropogenic Constructions In a Tetrahedral Mesh Of The Terrain Using The Meccano Method

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ABSTRACT

In this work, we present three different methods to insert any anthropogenic construction in a tetrahedral mesh of the terrain. The insertion of a construction in a mesh can be done with two different approaches: to insert it in the terrain before generating the mesh, or after the mesh is generated. We propose methods for both approaches; two for the former and one for the latter.

The strategy is based on a mesh generated by the Meccano method [1]. The Meccano method generates a mesh in the physical domain and a counterpart in a parametric space. To generate the counterpart, the first step is to map the terrain in the parametric space using the Floater parameterization [2]. Once the terrain parameterization is constructed we can insert the anthropogenic construction. The first technique is based on templates of the constructions. In the physical space, we locate the triangle where the construction has to be inserted, and we replace with the template the necessary triangles in both the physical and parametric domain. In the second technique, we capture the outline of the construction in the terrain of the physical domain. To insert it, we need to refine and project the edges of the elements to the path, and we replicate them in the parametric space. Then, the profile and top face of the constructions are generated using the parameterization. Once we have constructed the final geometry we generate the tetrahedral mesh using the Meccano method.

The last technique, is used when a tetrahedral mesh is constructed using the Meccano method with the original terrain. In the resulting mesh, we insert the profile and top faces. To include it, we consider each face as an independent surface, and we use a surface insertion technique [3]. Once all the surfaces are inserted we remove the inner elements.

The techniques we propose in this work allow to insert any geometry in a mesh generated using the Meccano method, while maintaining all the desired properties from the method such as a good-quality mesh, and a volume parameterization between the physical mesh and a parametric space.

References

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