Laplacian Subdivision Surfaces

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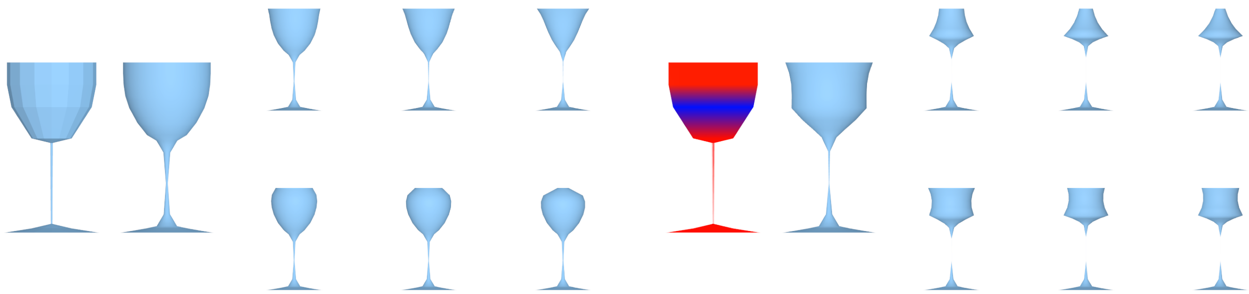

Figure 1: *Laplacian subdivision surface with weigth vertex group*

Abstract

This paper proposes a novel method for modelling poligonal mesh using subdivision surface and laplacian smoothing. This method use laplacian smooth for modelling global curvature in the model, to permit most flexible, robust and predictable results.

This method can correct traditional problems in extraordinary vertices present at catmull-clark subdivision method. The convergent rate of the laplacian smooth can be controlled by adjusting the weight in lambda parameter.

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I.3.5 [Computer Graphics]: Computational Geometry and Object Modeling —Curve, surface, solid, and object representations

Keywords: laplacian smooth, subdivision surface

1 Introduction

Mesh modelling from a coarse geometry is an important step in computer graphics process such as design, art and other fields.

1.1 Previous work

1.2 Overview of our method

Nuestro metodo usa el un bosquejo de maya le aplica una subdivision cualquiera y esa subdivision la modifica a lo largo de su curvatura de flujo usando un operador laplaciano

2 Theoretical Review of Related Work

2.1 Subdivision Surface

Subdivision is an iterated transformation [Warren and Weimer 2001]. Let F be a function (subdivision transformation) that maps one geometry M_i into another similar geometry with same topology M_{i+1}.

$$M_{i+i} = F\left(M_i\right) \tag{1}$$

The Catmull-Clark subdivision transformation is used to smooth a surface as the limit of sequence of subdivision steps[Stam 1998].

2.2 Curvature flow

2.3 Laplacian smooth

3 Proposed Method

Our method simplifies the design of irregular polygon meshes, generating a parameterized family of shapes using a set of vertices representing a coarse sketch of the desired model. Our method is iterative and converges towards a continuous and smooth version of the original model.

Unlike other methods, our method allows use mixtures of different types of representation adaptively as triangles and quads, exploiting the basic geometrical relationships facilitating and ensuring convergence of the algorithm and similar shapes consistent with the original shape against the other methods.

Our method allows the use of soft constraints weighting the effect of smoothing at each vertex based on a normalized weight, the weights are assigned to the control vertices of the original mesh or. The weights of the new vertices resulting from the iterations are calculated by interpolation, allowing to modify the behavior of the method on exact regions of the original model.

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3.1 Laplace Beltrami operator over triangular and quadrilateral meshes

3.1.1 Curvature normal calculation

3.1.2 Normalized curvature operator

3.2 Boundaries scale-dependent

3.3 Anti-shrinking fairing - Volume preservation

3.4 Weight based somooth constraints

4 Experimental Results and Applications

4.1 Implementation

4.2 Sparse linear system

5 Conclusion and future work

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References

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WARREN, J., AND WEIMER, H. 2001. *Subdivision Methods for Geometric Design: A Constructive Approach*, 1st ed. Morgan Kaufmann Publishers Inc., San Francisco, CA, USA.