Adventures with Topological Modeling

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Abstract

My interest in modeling started with fractal geometry While I was a Master student in Georgia Tech. During my PhD, I slowly moved to implicit modeling from fractal geometry. Looking back at the 1990's, I realize now that I was always interested in the development of algebraic structures for creating unusual shapes. During the 1990's, we only had implicit surfaces and solid modeling to provide such high genus models. I believed that implicit surface design must be like parametric surface design with control meshes and guaranteed interactivity. I have developed an algebraic framework to improve and simplify the mathematics behind implicit surfaces and I have achieved guaranteed interactivity. However, with rising popularity of subdivision surfaces, it was hard to continue to work on implicit surfaces. I realized that the main problem with subdivision surfaces was topology changes. My most significant and influential contributions as a researcher have been in the development of shape algebras for topological mesh modeling. My initial work on orientable surfaces has resulted in a powerful manifold mesh modeling system, called TopMod. By using TopMod, high genus manifold shapes can easily be constructed. The initial version of the software, TopMod has been available as free software since 2007. Since then, many talented artists have created very interesting sculptures TopMod. In the early 2010's, I moved in the development of algebraic structures for non-orientable surfaces, cyclic woven structures, and a special class of 3-manifold meshes. During the last five years, I have started to work in another direction, which we call partitive geometry. We construct unusual 3D tiles by using high-dimensional Voronoi sites that are closed under symmetry operations. For some examples of my recent work, you can view the following videos:

Topological Constructions: https://www.youtube.com/watch?v=xpR_3_szq5g
Delauney Lofts: https://www.youtube.com/watch?v=ytQOJdj2kIQ&t=25s
Biaxial Woven Tiles: https://www.youtube.com/watch?v=oCpYTyN2ELU
VoroNoodles: https://www.youtube.com/watch?v=DArBqF6Rk5c

Biography

I am a Professor of Visual Computing & Computational Media at Texas A&M University. I have been at Texas A&M University for 28 years. I received my Ph.D. degree in Electrical and Computer Engineering from the Georgia Institute of Technology in 1992. I had more than 200 publications in leading journals and conferences in a wide variety of disciplines from computer graphics, computer-aided design, and mathematics to art, architecture and social sciences. My most significant and influential contributions as a researcher have been in shape modeling and computer aided sculpting. I am also a professional cartoonist who has published more than 500 cartoons. I have a monthly corner called Computing through Time in the Flagship magazine of IEEE Computer Society, IEEE Computer. I also published weekly cartoons in "Herkese Bilim ve Technology" Newspaper.