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Decomposition, Approximation and Reconstruction of Shapes

Speaker: Prof. Jyh-Ming Lien
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Abstract

Decomposition is a common strategy to handle problems with large and complex geometry. Decomposition, in many cases, offers advantages over simplification from algorithmic perspective. The idea behind simplification is to reduce the input size to the applications. In contrast, decomposition can be viewed as changing shape representation, e.g., converting from non-convex to convex polygons, thus allowing more efficient algorithms. However, for models composed of millions (or more) of facets, fundamental geometric operations can still prohibitively slow even through decomposition. For instance, computing the Minkowski sum of the Stanford bunny and the David model, whose convex surface decompositions contain 16,549 and 85,132 components, resp., requires more than 1.4 billion geometric union operations.

In this talk, I will first introduce the idea of approximate shape decomposition. Then I will focus on a fundamental geometric processing tool that has no practical implementation via decomposition: Minkowski sum. Recent development of Minkowski sum has been based on the solution to a completely different problem, namely approximating the arrangement of the convolution. We will then establish the connection back to providing better decomposition through Minkowski sum under scaling. I will also discuss how decomposition and Minkowski Sums play the critical roles in several of our current projects.

Biography

Jyh-Ming Lien is an Assistant Professor in the Department of Computer Science and is affiliated with the Motion and Shape Computing (MASC) group and the Autonomous Robotics Laboratory at George Mason University. His research area is computational geometry, CAD/CAGD, algorithmic robotics, and computer graphics. His recent work focuses on shape decomposition, approximation and reconstruction of complex and dynamic 3D geometries. More information about his work can be found at: https://masc.cs.gmu.edu/