

Hybrid Symbolic and Numeric Operators as Tools for Analysis of Freeform Surfaces*

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Abstract

Freeform surfaces are commonly used in Computer Aided Geometric Design, so accurate analysis of surface properties is becoming increasingly important. In this paper we define *surface slope* and *surface speed*, develop visualization tools, and demonstrate that they can be useful in the design process. Generally, surface properties such as curvature and twist are evaluated at a finite set of predetermined samples on the surface. This paper takes a different approach. A small set of tools is used to symbolically compute surfaces representing curvature, twist and other properties. These surfaces are then analyzed using numeric techniques.

The combination of symbolic computation to provide an exact property representation (up to machine accuracy) and numerical methods to extract data is demonstrated to be powerful and robust. This approach supports a uniform treatment once the surfaces are computed and also provides global information, so questions such as ‘is a surface developable?’ or ‘what are the hyperbolic regions of a surface?’ can be answered robustly.