ASTERISK*: AN EXTENSIBLE TESTBED FOR SPLINE DEVELOPMENT

Jonathan R. Gross †
Tony D. DeRose ‡
Brian A. Barsky
Berkeley Computer Graphics Laboratory
Computer Science Division
Department of Electrical Engineering and Computer Sciences
University of California
Berkeley, CA. 94720
U.S.A.

Abstract

*Asterisk** is a testbed system designed to support the development of new kinds of splines. The key concept is the integration of *symbolic computation facilities* with tools for *interactively modifying and comparing* different splines. By modeling a spline as a list of attributes, *Asterisk** can be used to create and manipulate almost any spline, without making assumptions about the future directions of spline research.

Résumé

*Asterisk** est un système d'étude créé pour appuyer le développement de nouvelles sortes de courbes à base de splines. Le concept clef est l'intégration d'*outils interactifs pour modifier et comparer* différents courbes, avec un *système de calcul symbolique*. En décrivant une courbe par une liste d'attributs, le système *Asterisk** peut être utilisé pour créer et manipuler presque n'importe courbe à base de splines sans présumer les directions de cette recherche à l'avenir.

KEYWORDS: geometric modeling, software, symbolic computation, parametric curves.

* A Simple Testbed for the Evaluation and Rendering (Interactively) of Splines of many Kinds.

† Author's current address: Vertigo Systems International, Suite 221-119 West Pender Street, Vancouver, B.C. Canada V6B 1S5.

‡ Author's current address: Department of Computer Science, FR-35, University of Washington, Seattle, WA. 98195, U.S.A.

This work was supported in part by the Defense Advanced Research Projects Agency under contract number N00039-82-C-0235, the National Science Foundation under grant number ECS-8204381, the Natural Sciences and Engineering Research Council of Canada, the State of California under a Microelectronics Innovation and Computer Research Opportunities grant, and a Shell Doctoral Fellowship.

1. Introduction and Motivation

A *spline* is a mathematical formulation of a curve used for a wide variety of modeling applications. Unlike polygonal representations, splines provide compact and resolution-independent descriptions of complex objects. Many splines combine a set of *control vertices* with a set of *blending functions* to determine the path of a curve through space. Different splines have different properties, and the choice of which spline to use depends on the problem at hand. For example, some splines *interpolate* (pass through) the control vertices, while others *approximate* (pass near) them.

There is no single type of spline that is ideal for all applications; each spline is a tool best suited to some particular set of tasks. Current spline research involves developing new splines with specific properties as solutions to different problems. To create a spline representation with a desired set of properties, the blending functions must satisfy a set of *constraints.* Sometimes this involves combining constraints from existing splines to arrive at a new formulation [4]; in other cases it requires substantial trial and error to find a suitable set of constraints that produces the desired properties.

Most splines can be described mathematically in simple terms. In spite of this, establishing the constraints that correspond to desired properties, and then solving for a set of blending functions that satisfy those constraints is a task that can easily become overwhelming. Computer algebra systems such as *Vaxima* [5] can perform error-