Efficient Data-Parallel Tree-Traversal for Solid Modeling
Painting with Flowsnakes

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Professor Wyvill presents two projects, in modeling and computer assisted art.

Efficient Data-Parallel Tree-Traversal for Solid Modeling

Solid models, as used in CAD programs, have some advantages over mesh models, but complex solid models are slow to visualize. Such models are typically represented in a tree structure, and unlike mesh data, typical rendering methods require evaluation of the tree at many points in 3D space on and near the surface.

We present a general method for speeding up traversal of a solid modelling tree. The data structure exploits the SPMD programming model, by reducing the number of memory-reads, and ensuring that memory is retrieved in a predictable fashion.

We have found that the algorithm can achieve a speed-up of an order of magnitude over simple iterative tree traversal based on a linearized tree for a complex CSG model.

We demonstrate the performance characteristics of this algorithm with both procedurally generated data, and real-world models.

Painting with Flowsnakes

Space filling curves have long been used in halftoning and artistic applications. The Flowsnake, invented by Bill Gosper and popularized in Scientific American in the early 1970s, is based on a recursive hexagonal grid. Different grey levels can be obtained by subdividing the grid non-uniformly. In this work a sketch based application has been built to give the artist a brush that leaves a Flowsnake trail as each cell is touched and subdivided. Reverse-subdivision is also supported as well as using a background image to achieve an initial set of grey/colour levels, recursing to a deeper level where the grey level is darker. The Flowsnake algorithm has been linearized for fast GPU implementation.