

Informatics

Informatics Department Demonstration Handout

Stardent ST2000 Superworkstation

Introduction

Compared with a conventional workstation, the Stardent ST2000 has significantly greater computational and 3D graphics power. The demonstrations show these capabilities.

1 Movement of Crankshaft and Piston

This demonstration shows a crankshaft and a piston as they move through their regular cycle. They can be viewed from any direction. Not only can the crankshaft and piston be shown in shades of grey, but lighting effects can be simulated. Lighting can help us perceive the gradients and shapes of a complex object.

Results of a pressure calculation can also be shown, by displaying the values encoded as colours on the head of the piston. The colours change as the pressure field changes as successive phases of the cycle are traversed.

2 Molecules

To understand the structure of a molecule, it is useful to build a model, inside the computer. Some complex molecules can be modelled in this way. One of the molecules here is immunoglobulin which contains about 3500 atoms.

There is no single best way of visualising the molecule. Some ways focus on the atoms, others on the bonds between them. Several ways of visualising the molecule are possible with the program. One method displays the atoms as balls. Another displays the bonds as ribbons.

3 Bouncing Balls

This demonstration simulates the motion of up to 50 bouncing balls inside a box in 3D. Gravity is simulated and also the effects of elasticity when the balls collide - the effect can be bouncy or a dull thud.

Different starting patterns and different values of elasticity can be tried. The whole box can be turned over while all this is going on.

4 Spherical Harmonics

This shows the effect of harmonic oscillations on an elastic sphere. Just enjoy the distortions. Will it turn itself inside out?

5 The Applications Visualization System - AVS

Scientists and engineers know that one way to understand complex data is to use some graphical method of representing that data. Today's technology is opening up new ways of visualizing that data, using 3D methods. The AVS system is an example of a system that helps us do that. Data points inside a volume can be perceived using a number of techniques. If appropriate, data can be represented as a surface and the user can inspect the resulting surface.

This software shows the use of a new graphical input device, the spaceball. Where a mouse only works in 2D, the spaceball has other degrees of freedom. It responds to pressure from any direction and can also respond to an attempt to twist it. This can be particularly useful when trying to browse around and through a computer model of a 3D object.

6 Mathematica

Mathematica, described by its author, S. Wolfram, as "A System for Doing Mathematics by Computer", is essentially a computer algebra package with graphics capabilities

As well as performing numerical calculations, one of the most important features of Mathematica is that it can work with algebraic formulae as well as with numbers, including a large variety of mathematical functions.

On the Stardent ST2000, Mathematica can plot functions of one or two variables. One possible plot is to display a function, $f(x,y)$, as a surface in 3D space, with the height of the surface representing the value of the function, and with the surface shaded or coloured according to height.

7 Vibrating Plate

This program shows the vibrations of a disc being calculated and displayed by the ST2000. Each step takes a fraction of a second. (This program is not interactive)

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