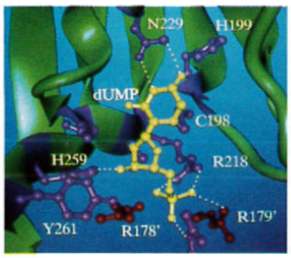
IRIS universe

p. 32

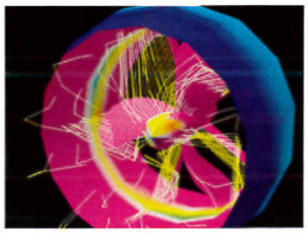
THE MAGAZINE OF VISUAL PROCESSING

ISSUE NUMBER FIFTEEN



p. 8

p. 40



p. 6

p. 22

DEPARTMENTS

6 SEQUENCE
Computational fluid dynamics hits the fan.

12 SOLUTIONS
Helpful tips for high speed image roaming.

48 PRODUCT BRIEFING
A new video windowing system with a built-in television tuner displays full motion video on the workstation monitor.

54 COMMUNITY FORUM
In Los Angeles, California the new Technical Exchange Council functions as a formal information channel between Silicon Graphics and users of IRIS computer systems.

ON THE COVER
One of the many worthy entrants in the First International Visual Processing Awards. This is one frame from an animation, depicting "currents embedded in a viscous flow with various wave sources and surface erosion." Created on an IRIS 4D/25 workstation at XAOS Computer Animation and Design in San Francisco, California.

FEATURES

8 BEST SHOTS
The ten winning images from the 300 submitted to the First International Visual Processing Awards

10 ANNOUNCING THE SECOND INTERNATIONAL VISUAL PROCESSING AWARDS
Everything you need to enter this year's competition.

16 IRISVISION!™
By Cynthia Marshall
A new graphics board-set bring state-of-the-art visual processing to personal computers.

22 RESURRECTING A 17TH CENTURY ARTIST
By Crispin Littlehales
England's Graphic Palette used an IRIS workstation to aide in the restoration of a 350-year-old ceiling frieze.

26 IRIS SHOWCASE™
By Thomas Davis
This new drawing and presentation tool allows users to include 3D models and raster images in documents, as well as the usual 2D images and text. What's more, it's fun!

32 THE DIGITAL LANDSCAPE
By Pierre Dinouard and Patrick Renvoise
Out of France comes the first software product that animates the growth of plants and trees.

35 COMPUTERS AND THE HUMAN GENOME
By James M. Averback
The management of massive amounts of information will be a crucial requirement of the Human Genome Mapping Project. The author discusses how Fels Institute at Temple University Medical School plans to tackle the job.

40 VISUAL PROCESSING IN THE LAND DOWN UNDER
By Hannah Watterson
From Sydney to Canberra, from Victoria to Melbourne — from engineers to artists — Silicon Graphics workstations are changing the way Australians work.

44 TAKING FLIGHT: THE MAKING OF A SIMULATOR
The creation of a flight simulator using a standard, commercial, off-the-shelf workstation as the basis of a complete system.

THE DIGITAL LANDSCAPE

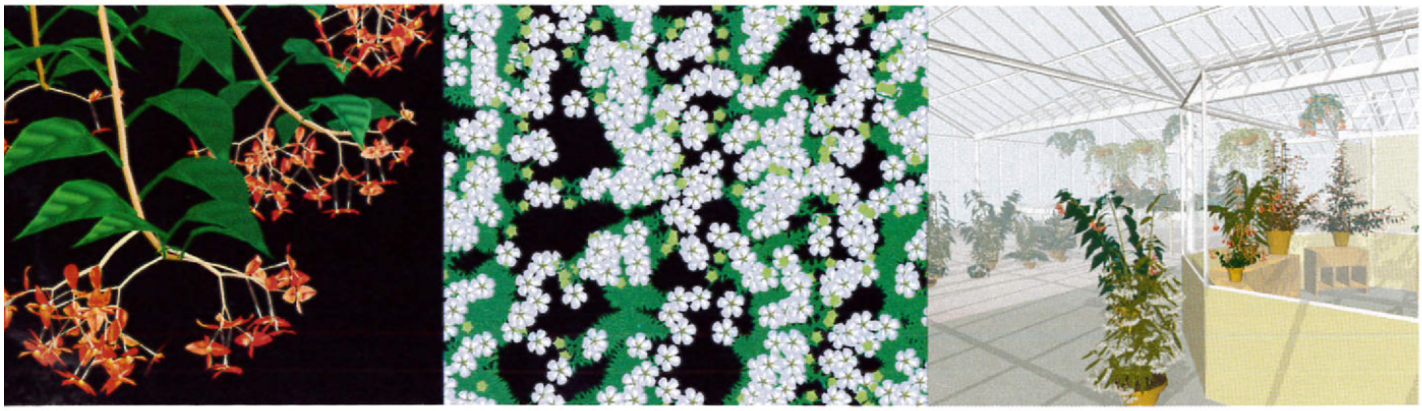
BY PIERRE DINOUARD AND PATRICK RENVOISE

A company in Montpellier, France has developed a new software product that animates the growth process of plants and trees, and has potential for numerous and diverse applications.

One rarely sees realistic trees in cartoons. That's because nature, particularly plant growth, is difficult to animate. In fact, there is only one organization on earth that has figured out how to do it: CIRAD's Laboratoire de Modelisation.

Located in Montpellier, France, CIRAD is a center for international cooperation in development-oriented agricultural research, with an emphasis on tropical and subtropical zones. CIRAD, established in 1984, is funded partly by government contributions and partly through private research contracts. There are eleven research departments within the organization. Eight of these concentrate on commodity-based research, while two others focus on theme-based research. The remaining department, called GERDAT, handles horizontal programs and general services. The Laboratoire de Modelisation is part of GERDAT and has full responsibility for the development and maintenance of CIRAD's plant modeling software package, AMAP.

Last year, CIRAD introduced AMAP to the computer graphics community at SIGGRAPH. CIRAD's high resolution animation depicting the growth of various plants and trees was created on a Silicon Graphics 4D/70 GT workstation. A major technological breakthrough, it was the first computer visualization of the botanical growth process. CIRAD's work has received a great deal of attention and acclaim. The imagery



presented in the Laboratoire's 3D film, *Palmeraie sous la brume*, received the Grand prix de l'image scientifique at the PARIS CITE 90 creative technology exhibition. More recently, CIRAD was one of the winners in Silicon Graphics' Visual Processing Awards with its rendering of the "Growth Simulation of a Begonia Elithe" (see page 9).

AMAP is based on a revolutionary theory of plant growth modeling that was invented by Phillipe De Reffye, director of the Laboratoire. De Reffye spent more than a decade in Africa observing plant growth and formulating mathematical algorithms to describe the growth process, including the random growth of leaves and branches. Upon returning to France in 1983, De Reffye began working with a student of computer graphics to build software that provided simplified graphic renditions of the biological plant growth parameters. These very basic images were output on a plotter.

In 1987, the Laboratoire de Modelisation installed its first Silicon Graphics system (a series 3000). This enabled De Reffye and others to visualize the results of the statistical processes that had been applied to measuring plant growth and to begin development of the AMAP program. There are currently two Silicon Graphics 4D/20 and two 4D/25 systems as well as one 4D/70GT workstation in use at the Laboratoire. The AMAP software now supports applications that go far beyond the original agronomy-oriented research. Moreover, the resulting graphics can be output directly to film.

Research and development of AMAP involved a number of different scientific disciplines; agronomy, botany, mathematics and computer graphics. Specialists from each of these areas worked closely to develop models for understanding the biological phenomena that controls plant growth and population dynamics.

The software has two main components; the AMAP Engine and Engine HQ and the AMAP LandMaker. The Engine serves as a plant growth simulator with 3D output in the form of a skeleton tree or plant figure. It receives information regarding the biological plant growth parameters from the Growth Database. The Terrain module generates terrain information with isovalue curves and filled surfaces. An Access module provides a CAD-CAM interface and the Figures module has a quick 3D modeler for geometrical patterns such as leaves and fruit.

LandMaker serves as a 3D scenes editor for landscapes, gardens, interior decoration and urban scenery imaging. The Renderer provides fast realistic rendering options including shadows, texture mapping and fog. The Material module has a material characteristics editor for the renderer and the Glance module supports quick, interactive 3D visualization. A Cartoon module functions as an animation editor with a video interface to monitor the videotape recorder. AMAP runs on all Silicon Graphics workstations and generates both static and dynamic images that can output to printers or directly to film. Users can view their work either on the system monitor or on a VCR.

In addition to addressing the core issues of agriculture, forestry and environmental research, AMAP is being used for architecture, landscaping, urban planning, real-estate development, education and animation.

AMAP creates accurate simulations of plants to predict their behavior as crops. The software also can model the biological processes that regulate the interactions between host plants, pests, their predators and parasites. Additionally, it can predict plant behavior in urban or developed environments for long-term landscape management. And, if one wished, it could be used to grow trees in cartoons.

For more information about AMAP and its applications, contact: Pierre Dinouard, Laboratoire De Modelisation Cirad-Gerdat, BP 5035, 34032 Montpellier Cedex 1, France, (33) 67 61 59 95.

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