





ChapReyes™ on the Pixar Image Computer™ provides high-quality image synthesis at impressive speeds. ChapReyes includes many of the innovations in image synthesis pioneered by Pixar in a software package that exploits the fast parallel architecture of the Chap™ channel processor. This powerful tool is being applied to product design, broadcast and industrial television, simulation and 3-D visualization.

SPEED

The Pixar Image Computer's Chap operates at 40 million instructions per second. The system may be expanded to include three Chaps resulting in a speed of 120 MIPS. This processing power embedded in the unique system architecture of the Pixar Image Computer results in a rendering engine of impressive speed.

- ChapReyes generates high-quality images at speeds up to 50 times faster than a standard superminicomputer.
- Rendering speeds can average 50,000 to 100,000 polygons per minute, for example, in scenes using multiple light sources, a polygon size of 1-5 pixels, smooth shading, anti-aliasing and opaque surfaces.
- ChapReyes with three Chaps runs almost 3 times faster than with a single-Chap.
- For quick previewing during the design cycle, even higher speeds can be achieved by deactivating anti-aliasing, using flat shading, decreasing polygon size and lowering the resolution of the result.

REALISM

Many techniques are available in ChapReyes to bring realism to geometric models.

- *Anti-aliasing*
Supersampling up to 64 samples per pixel eliminates the jagged edges.
- *Texture maps*
Texture maps provide models with realistic surface textures.

- *Environment maps*
Global scene reflections put models into a realistic environment.
- *Light sources*
Control of color, strength, direction and locality of up to 32 light sources allows realistic scene lighting.
- *Shading*
A choice of shaders including Phong, Gouraud, and flat provides accurate models of light reflections from surfaces.

MODELER INTEGRATION

ChapReyes may be integrated with external modelers through a high-level C-subroutine interface. This interface supports a large variety of image description, storage, and transfer formats. The geometric primitives supported directly are bicubic B-spline patches, polygonal meshes, triangles and quadrilaterals. In addition, there are utilities that support the popular *movie.byu* format and B-spline grids.

BROADCAST ANIMATION

Combining ChapReyes with the image-processing capabilities of the Pixar Image Computer provides a very powerful tool for broadcast animation. Synthetic and real images may be manipulated in a large number of ways including sharpening, softening, color shifts, rotations, wraps, and scaling. These images can then be composited to produce seamless montages, composite images and animations. The large image memory of the Pixar Image Computer allows for easy preview of the results which may then be output to videotape using the broadcast-quality NTSC or PAL video formats.

ADVANCED RENDERING TECHNOLOGY

The Reyes image synthesis architecture was developed by the technical experts at Pixar for the demanding needs of the film industry. Pixar now offers the benefits of this development, coupled with the fastest hardware in the industry, for commercial applications.

COVER IMAGES (left to right, top to bottom):

TERRAIN RENDERING: Created by texture mapping a thematic mapper image of a section of Nevada onto a rendering of the terrain derived from Digital Terrain Elevation Data. Image courtesy of The Analytic Sciences Corporation (TASC).

UNICYCLE: Generated from 2,700 bicubic patches and rendered using ChapReyes in 90 seconds. It features reflection maps, texture maps, multiple light sources and anti-aliasing. Created by Pixar.

3-D IMAGE SYNTHESIS: A synthetic image modeled with 280,000 polygons on the Symbolics 3675 and rendered in 3 minutes on the Pixar Image Computer. Created by the Symbolics Graphics Division, Larry Malone and Michael Wahrman.

INDUSTRIAL DESIGN: "Steering Wheels." Modeled on the ALIAS/1™ 3-D animation and design system and rendered in 1 minute using ChapReyes. Created by Leon Soren.

SATELLITE IMAGE ANALYSIS: This image contains fractalized cloud data from GOES (infrared) satellite imagery suspended above a Landsat image of Silicon Valley. Both clouds and landscape were rendered with texture mapping using ChapReyes. Image courtesy of TASC.

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