SOLIDVIEW™

SOLID MODELING DISPLAY SYSTEM (PATENT PENDING)

SOLIDVIEW is Lexidata's exclusive, patent pending technology for the display of solid models. Featuring a special combination of hardware and firmware, SOLIDVIEW offers interactivity and speed by providing local hidden surface removal and local visible surface shading. Available in both medium (640x512) *and* high (1280x1024) resolutions, SOLID-VIEW provides a cost-effective solution for any solid modeling or three dimensional (3-D) graphics application. SOLIDVIEW increases overall system speed, thereby reducing host overhead and software development time.
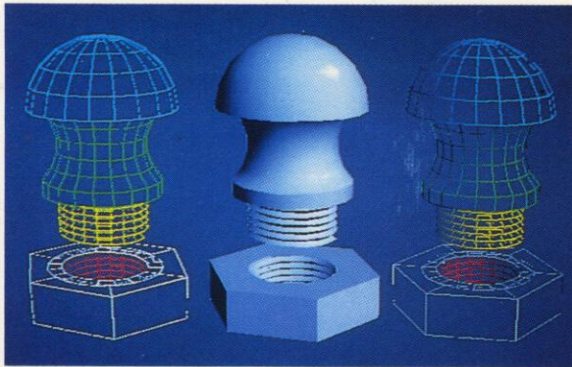
SOLIDVIEW is compatible with a variety of application software packages such as Brigham Young University's Movie.BYU™.
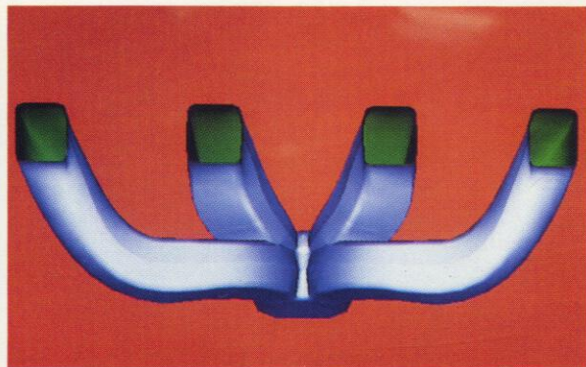
Manifold design as displayed by SOLIDVIEW and Delta Computer Aided Engineering Ltd.'s DUCT™ software.
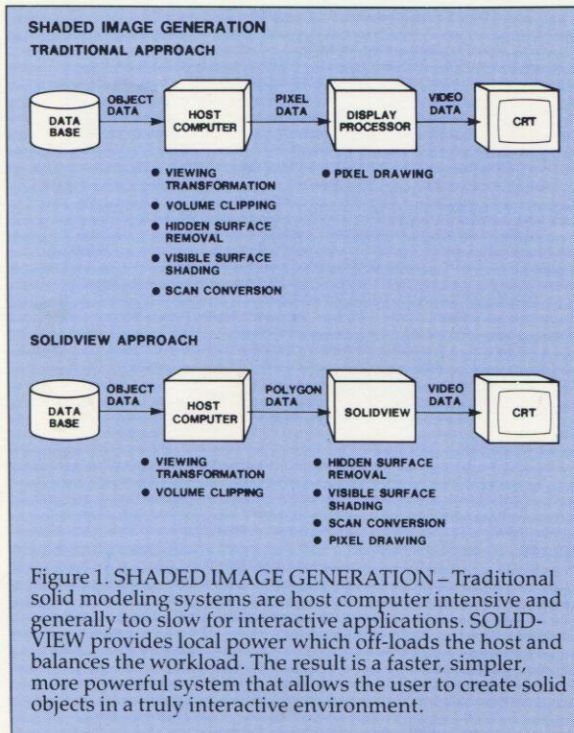
FEATURES

- Available in Both 640x512 *and* 1280x1024 Resolutions
- Local Hidden Surface Removal and Local Visible Surface Shading
- 3-D Graphics Primitives
- Translucent Surface Mode
- Supported by a Variety of Third Party Software Packages

BENEFITS

- Satisfies a Wide Range of Solid Modeling Applications
- Offloads the Host Computer
- Provides a High-Level Interface to Application Programs; Reduces Host I/O
- Allows Interior View of Object; Detects Surface Interference
- Offers Flexibility for Multiple Application Needs

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SOLIDVIEW vs. "STANDARD" APPROACHES

To understand the power and advantages of SOLIDVIEW, it is necessary to compare the SOLIDVIEW approach with today's standard shaded image techniques. Using traditional methods, object data from the host computer data base is processed completely by the host and output as pixels to the display processor. The host transforms and clips the object into a viewing volume, removes hidden surfaces, and calculates pixel values for each visible surface. Usually the entire image must be created at the host before pixel data is sent to the display processor. This results in a long delay before the first pixel is sent, and then the image appears one scan line at a time. The display processor acts only as a frame buffer to store the resultant image. This approach is heavily unbalanced, host intensive, and underproductive. Even after much computation by the host, the image appears slowly since it is transmitted pixel-by-pixel.

Figure 1. SHADED IMAGE GENERATION – Traditional solid modeling systems are host computer intensive and generally too slow for interactive applications. SOLIDVIEW provides local power which off-loads the host and balances the workload. The result is a faster, simpler, more powerful system that allows the user to create solid objects in a truly interactive environment.

As shown in Figure 1, SOLIDVIEW provides a new, faster approach to shaded image generation. While the host computer continues to perform the viewing transformation and volume clipping, the rest of the work is done by SOLIDVIEW. Working from 3-D polygon data that includes shades at the polygon's vertices, SOLIDVIEW removes hidden surfaces and displays visible surfaces with smooth shading interpolated from the polygon data. Since these operations are done in SOLIDVIEW's bipolar processor, they are completed at speeds far greater than a host computer could manage.

SUPPORTS THREE SHADING TECHNIQUES

SOLIDVIEW supports popular Gouraud, Polyhedron, and Phong shading techniques.

Gouraud shading (intensity interpolation) involves polygons that are transmitted by the host with intensity values for each vertex. The result is smooth shading with minimal host calculation. Since SOLIDVIEW removes hidden surfaces automatically, this operation can be performed on each polygon as soon as it is transmitted by the host. The result is parallel processing by the host and SOLIDVIEW, and the smoothly shaded solid object is typically complete in a few seconds.

With Polyhedron shading, each polygon is given constant shading. This requires less computation for the host and for SOLIDVIEW.

Phong shading (normal-vector interpolation) provides the same smooth shading method as the intensity interpolation, but the host provides two values to be interpreted for each vertex of the polygon. While this approach requires slightly more calculation by the host and by SOLIDVIEW, it now becomes possible to vary the light source position by changing the Lookup Table (LUT) values. The light source can appear to move smoothly across the shaded image, providing additional detail about the part being viewed.

SOLIDVIEW utilizes a technique known as incremental construction when "building" objects. Each polygon is shaded as it is
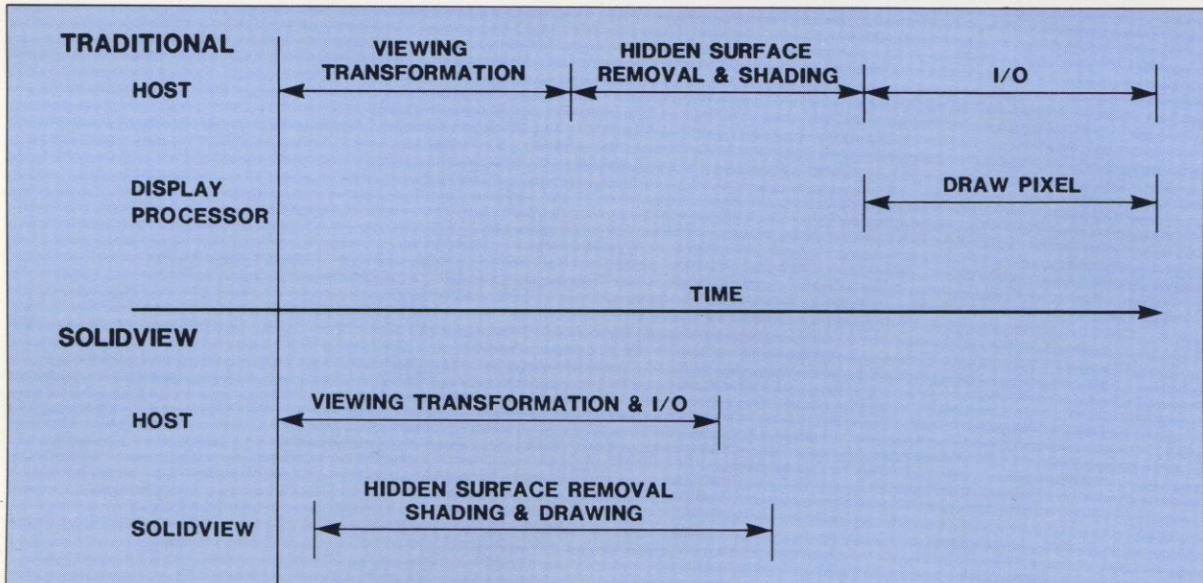
TRADITIONAL	**VIEWING TRANSFORMATION**	**HIDDEN SURFACE REMOVAL & SHADING**	**I/O**
HOST			
DISPLAY PROCESSOR			**DRAW PIXEL**

TIME ➞

SOLIDVIEW		
HOST	**VIEWING TRANSFORMATION & I/O**	
SOLIDVIEW	**HIDDEN SURFACE REMOVAL SHADING & DRAWING**	

Figure 2. PERFORMANCE COMPARISONS: TRADITIONAL VS. SOLIDVIEW — Traditionally, the entire image is constructed at the host computer and then sent pixel by pixel to the display processor. Not only is this process slow, it is I/O and host intensive, and requires large amounts of memory. With SOLIDVIEW, the workload is shared evenly with the host. As soon as the first polygon is computed, it is sent to the SOLIDVIEW system where hidden surfaces are removed, visible surfaces are smoothly shaded, and the result is displayed. The response is virtually immediate, and the solid model builds in a visually useful sequence.

drawn, and subsequent polygons hide the areas behind them. This feature provides added information and allows the user to see how the object and its various components fit together.

WORKS WITH HOST TO INCREASE THROUGHPUT

In addition to providing local computing power (especially important for the display of solid objects), SOLIDVIEW offers parallel processing with the host computer. As soon as the first polygon is ready for display, it is output to SOLIDVIEW and displayed immediately. Figure 2 compares SOLIDVIEW with conventional approaches and shows the time savings realized by this parallel processing. SOLIDVIEW provides a completed picture in much less time, with less computation in the host, and the first part of the picture begins to appear almost immediately. SOLIDVIEW's combination of local computing power and parallel processing provides

the speed required for highly interactive solid modeling applications. And SOLIDVIEW does it all at an affordable price.

Cuts Data Storage Requirements in Host

Since SOLIDVIEW can handle 3-D data directly, the host does not have to use hidden surface removal and visible surface shading algorithms. These typically require pixel-by-pixel generation of the entire image before transmission to the display processor. As a result, the need for host memory commensurate with the displayed image (frequently larger than 1 Mbyte) is eliminated. Smaller memory requirements eliminate a costly host burden.

"SEE INSIDE" A SOLID MODEL

As each polygon is sent to SOLIDVIEW, visible surfaces of the new polygon hide the surface behind them. At the user's option, however, SOLIDVIEW can use a translucent pattern rather than an opaque shade. Since the translucent pattern only writes selected

pixels, some of the information behind the added polygon is still visible. This can be thought of as a "screen door effect", and by proper specification of the translucent pattern, important details inside the solid model can remain visible even as other parts are added to the view.

DOCUMENTATION, SERVICE, AND SUPPORT

Lexidata is committed to helping SOLID-VIEW users make optimal use of their system and to keeping it running smoothly. A complete series of documentation is provided so that the user can learn the operation of the system. Informative in-house or on-site training courses regarding system operation and programming are offered through the Lexidata Technical Education Department. Service and maintenance contracts are available, and systems engineering support is provided for fast response to technical questions.

SUMMARY

SOLIDVIEW is Lexidata's patent pending technology for the display of solid models. By providing local hidden surface removal and local visible surface shading, SOLID-VIEW greatly reduces host computer loading and provides the speed required for highly interactive solid modeling applications. SOLIDVIEW's special features add speed and flexibility to any application involving 3-D models, and its ability to work in parallel with the host computer provides instant feedback to the user.

SOLIDVIEW SPECIFICATIONS

Alphanumerics
An alphanumeric character font is provided which supports upper case text, numerals, and punctuation. The font size is 5x7 pixels in a 7x9 field.

Cursor
Size and shape of non-destructive cursor is user-loadable within 64 pixel x 64 pixel matrix. Full screen cross-hair is also selectable.

Average Polygon Write During Shading and Hidden Surface Removal
34SV-2 1000 polygons/second
34SV-3 1150 polygons/second

Data Transfer Rate
Parallel interface — Up to one megaword (16 bits/word) per second from host computer in burst mode. Serial interface — Switch selectable to rates up to 19.2K baud.

Power Requirements
Voltage: 115VAC ±10% 47-63Hz (3 wire)
           230VAC ±10% 47-63Hz (3 wire)
Consumption: 600 watts average
Requirements vary depending on configuration size.

Environmental Requirements
Operating Temperature
10 to 40 degrees C
Storage Temperature
-35 to 70 degrees C
Operating Relative Humidity
10% to 90% (non-condensing)
Storage Relative Humidity
10% to 90% (non-condensing)
Altitude
8,000 feet
Acoustic Noise Level
The acoustic noise level shall not exceed the NC-60 noise criteria curve.

Chassis Dimensions
8.75" high x 19" wide x 27" deep
Weight: 60-100 lbs. including power supply
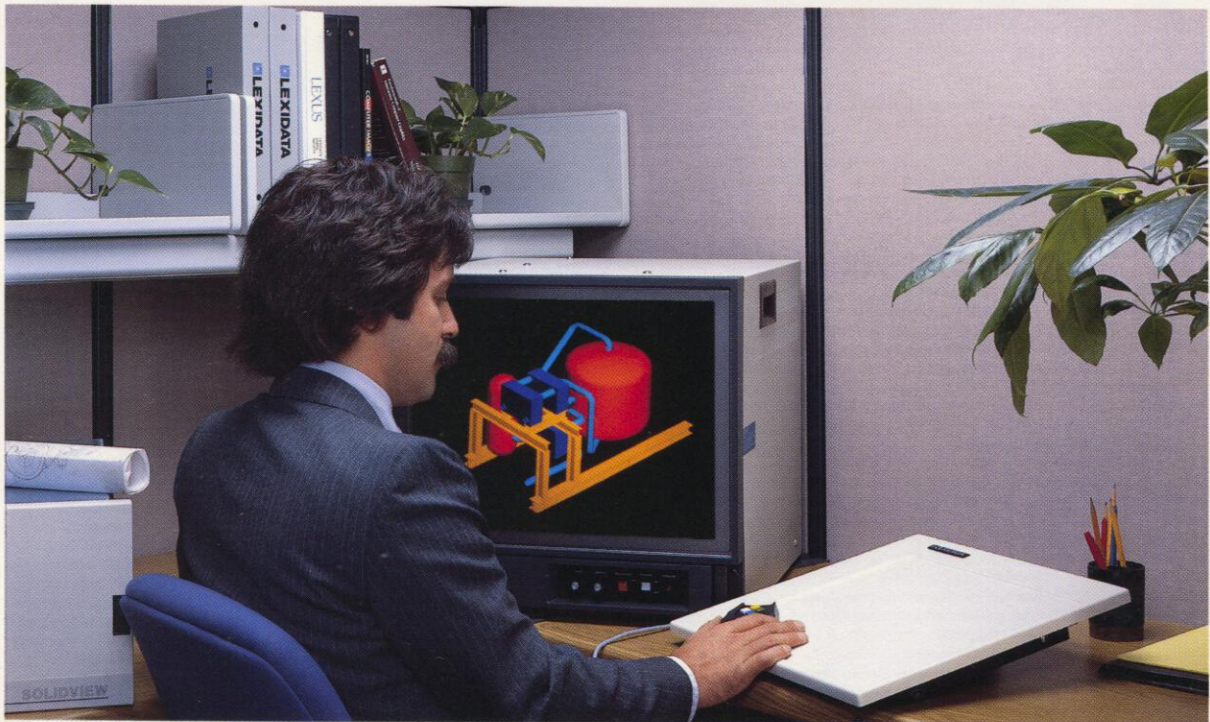
Peripherals (Optional)
Keyboard   Data Tablet w/stylus or
3-D Joystick   Data Tablet w/puck

This small chemical processing plant was designed using Manufacturing and Consulting Services Inc.'s ANVIL-4000™ software and SOLIDVIEW.

APPLICATION SOFTWARE SUPPORT

SOLIDVIEW is compatible with a variety of the world's leading application software packages. The following is a representative list of available third party software packages which support SOLIDVIEW:

VENDOR	SOFTWARE PACKAGE
Brigham Young University	MOVIE.BYU™; MINI-MOVIE.BYU™
Delta Computer Aided Engineering Ltd.	DUCT™
DIS/ADLPIPE Inc.	DIS/ADLPIPE™
GE CAE International Inc.	SDRC I-DEAS™
Interactive Computer Modelling Inc. (ICM)	Geometrical Modelling System™
Manufacturing and Consulting Services Inc. (MCS)	ANVIL-4000™
Matra Datavision	EUCLID™
PDA Engineering	PATRAN-G™

SOLIDVIEW CONFIGURATION SUMMARY

Model	34SV-2	34SV-3
Display resolution	640x512	1280x1024
Display refresh rate	25/30Hz Interlaced	25/30Hz Interlaced
Standard display memory	12 planes	8 planes
Standard depth buffer memory	12 planes	12 planes
Overlay memory	4 planes	1 plane
Color lookup table	12x24	8x24
Maximum number of simultaneously displayable colors	4096	256
SCP peripheral interface with hardware cursor	Standard	Standard
Pan/zoom controller	Standard	Not Available
Host interface	Serial or Parallel	Parallel Only
Chassis	12 slot	12 slot
Monitor (19" in-line color LP)	Standard	Standard

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