PACKAGE ID - 000739SGIIP01 RUNTHRU6.0

KWIC TITLE - Translation, Enhancement, Filtering, and Visualization of Large 3D Triangle Mesh

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LIMITATION CODE -UNL **AUDIENCE CODE -** UNL

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DESCRIPTION - The runthru system consists of five programs: workcell filter, just do it, transl8g, decim8, and runthru. The workcell filter program is useful if the source of your 3D triangle mesh model is IGRIP. It will traverse a directory structure of Deneb IGRIP files and filter out any IGRIP part files that are not referenced by an accompanying IGRIP work cell file. The just do it program automates translating and/or filtering of large numbers of parts that are organized in hierarchical directory structures. The transl8g program facilitates the interchange, topology generation, error checking, and enhancement of large 3D triangle meshes. Such data is frequently used to represent conceptual designs, scientific visualization volume modeling, or discrete sample data. Interchange is provided between several popular commercial and defacto standard geometry formats. Error checking is included to identify duplicate and zero area triangles. Model engancement features include common vertex joining, consistent triangle vertex ordering, vertex noemal vector averaging, and triangle strip generation. Many of the traditional O(n2) algorithms required to provide the above features have been recast and are o(nlog(n)) which support large mesh sizes. The decim8 program is based on a data filter algorithm that significantly reduces the number of triangles required to represent 3D models of geometry, scientific visualization results, and discretely sampled data. It eliminates local patches of triangles whose geometries are not appreciably different and replaces them with fewer, larger triangles. The algorithm has been used to reduce triangles in large conceptual design models to facilitate virtual walk throughs and to enable interactive viewing of large 3D iso-surface volume visualizations. The runthru program provides high performance interactive display and manipulation of 3D triangle mesh models.

PACKAGE CONTENTS - Media Directory; Software Abstract; Workcell Filter Program Description; Just Do It Program Description; TRANSL8G User Guide; DECIM8 User Guide; RUNTHRU User's Guide Version 6.0; RUNTHRU System Installation; Media Includes Source Code, User's Guide,

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PACKAGE CONTENTS -(CONT) Executable Module, Compilation Instructions, Sample Problem Input, Programmer Documentation;

SOURCE CODE INCLUDED? - Yes

MEDIA QUANTITY - 1 CD Rom

METHOD OF SOLUTION - The workcell filter program uses recursion to traverse a hierarchical directory structure. It uses the UNIX grep command on each IGRIP part file with its corresponding workcell file to determine if the workcell file references the part file. The just do it program also uses recursion to traverse a hierarchial directory structure. It uses the UNIX system command to execute transl8g and/or decim8 on each data file found. The transl8g data input consists of vertex coordinates and optional triangle vertex indices, triangle normal vector indices, and normal vectors. This information is used to automatically determine model topology. Topology information is used to create a data structure that identifies all triangles connected to each vertex. This is the primary data structure used by many of the algorithms. Noemal vector information and triangle strips may be computed for each triangle. The decimation algorithm reduces triangles in a 3D mesh by identifying acceptable candidate triangle topologies, determining triangle elimination admissability, eliminating vertices and triangles, and retriangulating the eliminated triangles area with fewer triangles. The above process is performed iteratively where each iteration represents a pass through all remaining model vertices. When iterations no longer yield reductions in model triangles the decimation admissability criteria may be incrementally increased. This procedure is repeated until either the desired reduction in model size is achieved, maximum increment or iteration values are reached, or no further reduction is obtained. The runthru program accepts model geometry in the form of triangle strips. This format is supported by transl8g and decim8. The runthru program uses OpenGL for graphics display and GLUT for the graphical user interface.

COMPUTER - SILICON GRAPHIC

OPERATING SYSTEMS - SGI IRIX 5.3

PROGRAMMING LANGUAGES - C

SOFTWARE LIMITATIONS - The runthru system programs' resource requirements are problem size related. The most limiting resource is memory and graphics acceleration hardware speed for display. The work cell filter and just do it programs require UNIX commands. The transl8g program supports several common 3D geometry file formats, but is limited to triangle geometries only. Texture coordinates are not currently supported. The decim8 and runthru programs use a triangle strip file format which is produced by transl8g.

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SOURCE CODE AVAILABLE (Y/N) - Y

UNIQUE FEATURES - The transl8g algorithms are efficient for large model sizes that exceed 100,000 triangles. An extremely effective common vertex joining algorithm is included. A triangle strip generation algorithm is included that supports exploitation of graphics rendering hardware accelerators. The decim8 program significantly reduces the number of triangles in large 3D triangle meshes very quickly while preserving the relevant features. The runthru program has an intuitive user interface and is tuned to SGI graphics hardware to optomize rendering speed. It supports hierarchial model structures, fast intersection calculations, high performance picking, and real time 3D measurement.

OTHER PROG/OPER SYS INFO - OpenGL graphics library and GLUT library are required for the runthru program.

HARDWARE REQS - UNIX workstation having 50 - 150 SPEC92 performance, 128-256 MB main memory, and 1 GB disk space are typical for model sizes in the order of 500,000 - 1,000,000 original triangles.

TIME REQUIREMENTS - Run time requirements are highly dependent on the original model size and the amount of triangle filtering desired. an approximate rule of thumb for transl8g is less than sixty seconds for models in the order of 400,000 triangles. an approximate rule of thumb for decim8 is reduction of 1000 - 2000 triangles per second. times are based on a UNIX workstation with a processor rated at approximately 60 SPEC92 performance.

REFERENCES - D.M. Ross, workcell filter Program description, December 1994; D.M.Ross, workcell filter tutorial, February 1997; D.M. Ross, Just do it Program description, October 1994; D.M. Ross, just do it Tutorial, February 1997; F.X. Janucik, and D.M. Ross, TRANSL8G - A Data Translation and Geometry Processor for Large 3D Triangle Meshes, July 1994; F.X. Janucik, and D.M. Ross, TRANSL8G User Guide, February 1994; D.M. Ross, DECIM8 A 3D Data Filter for Triangle Mesh Models, KAPL-4765, September 1993; F.X. Ross and D.M. Ross, DECIM8 User Guide, February 1997; F.X.Janucik, decim8 tutorial, February 1997; F.X. Janucik, Fast, Large Scale, 3D Triangle Interference Calculations, June 1994; K.F. Sischo, RUNTHRU User's Guide, Version 6.0, January 1997; K.F.Sischo, runthru tutorial, February 1997; D.M. Ross and K.F. Sischo, runthru System Installation, february 1997; F.X. Janucik, HTML Web Pages For On-Line runthru97 Documentation Distribution, February 1997.

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SUBJECT CLASS CODE - NP

KEYWORDS -
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SPONSOR - DOE/NE

PACKAGE TYPE - SCREENED