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Infinite Possibilities:
Computational Structures Technology

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Computational Fluid Dynamics (or CFD) methods are very familiar to the research community. Even the general public has had some exposure to CFD images, primarily through the news media. However, very little attention has been paid to CST--Computational Structures Technology. Yet, no important design can be completed without it.

During the first half of this century, researchers only dreamed of designing and building structures on a computer. Today their dreams have become practical realities as computational methods are used in all phases of design, fabrication and testing of engineering systems. Increasingly complex structures can now be built in even shorter periods of time. Over the past four decades, computer technology has been developing, and early finite element methods have grown from small in-house programs to numerous commercial software programs. When coupled with advanced computing systems, they help engineers make dramatic leaps in designing and testing concepts.

The goals of CST include: predicting how a structure will behave under actual operating conditions; designing and complementing other experiments conducted on a structure; investigating microstructural damage or chaotic, unpredictable behavior; helping material developers in improving material systems; and, being a useful tool in design systems optimization and sensitivity techniques. Applying CST to a structure problem requires five steps: 1) observe the specific problem; 2) develop a computational model for numerical simulation; 3) develop and assemble software and hardware for running the codes; 4) post-process and interpret the results; and 5) use the model to analyze and design the actual structure.

Researchers in both industry and academia continue to make significant contributions to advance this technology with improvements in software, collaborative computing environments and supercomputing systems. As these environments and systems evolve, computational structures technology will evolve. By using CST in the design and operation of future structures systems, engineers will have a better understanding of how a system responds and lasts, more cost-effective methods of designing and testing models, and improved productivity.

For informational and educational purposes, a videotape is being produced using both static and dynamic images from research institutions, software and hardware companies, private individuals, and historical photographs and drawings. The extensive number of CST resources indicates its widespread use. Purdue University, Lawrence Livermore National Laboratory, Sandia Laboratories, Boeing, Langley, Johnson, and Lewis Research Centers, ANSYS, MSC NASTRAN, Cray, Inc. and several other locations have submitted images, either on videotape or in a digital file format. Applications run the gamut from simpler university-simulated problems to those requiring solutions on supercomputers. In some cases, an image or an animation will be mapped onto the actual structure to show the relevance of the computer model to the structure.

Transferring the digital files to videotape presents a number of problems related to maintaining the quality of the original image, while still producing a broadcast quality videotape. Since researchers normally do not create a computer image using traditional composition theories or video production requirements, often the image loses some of its original digital quality and impact when transferred to videotape. Typical problems include: image size perspective (not created in video format of three by four); color (the full color saturation of the image cannot be reproduced on video); an overabundance of red in an image, as well as other problems. Although many CST images are currently available, those that are edited into the final project must meet two important criteria: they must complement the narration, and they must be broadcast quality when recorded on videotape.