Inverse Interactive Computer Graphics Techniques for Acoustic Visualization

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PROGRAM AREA

Virtual Environments

KEYWORDS:

computer graphics, inverse problems, scientific visualization, acoustic design, architecture.

PROJECT SUMMARY

Acoustic visualization using computer graphics suffers from two major drawbacks. First, current techniques for the propagation of sound in an environment are not sufficient to yield the required level of accuracy necessary to evaluate a space acoustically. Second, even if the simulations were accurate, obtaining the correct acoustic effects may require a long, tedious sequence of modeling/simulation steps, as one needs to simulate the sound propagation in the entire scene in order to preview the result. In this project, we are refining the accuracy of acoustic simulation techniques with a number of theoretical extensions. In addition, we are developing a set of interactive techniques that provide the means to directly indicate desired acoustical effects in a three-dimensional computer model. By creating and altering these effects, the surfaces, sound emitters, and geometry are indirectly modified. The system absorbs much of the burden of searching the design space, allowing the user to focus on the goals of the acoustical design, rather than the intricate details of a complete model specification.

PROJECT REFERENCES

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AREA BACKGROUND

Historically, acoustic design has been a difficult process, one that has been plagued by hit or miss techniques. Traditionally, designers have built physical scale models and tested them visually and acoustically. For example, by coating the interiors of the models with reflective material and then shining lasers from various source positions, they try to assess the sight and sound lines of the audience in a hall. They also might attempt to measure acoustical qualities of a proposed environment by conducting acoustic tests on the model using sources and receivers scaled in both frequency and size. Even water models are used sometimes to visualize the acoustic wave propagation in a design. These traditional methods have proven to be inflexible, costly, and time consuming to implement.

Recent advances in computer hardware have made it possible to visually render and explore geometrically modeled settings (virtual environments) in real time or at interactive rates. Acousticians, audio engineers, architects, and physicists are presently developing new ways to expand these models to the sound domain. Computer simulation can be used to generate the spatial and temporal data describing the acoustic behavior of environments. Computer graphics techniques can be used to display the multidimensional data, allowing substantially greater amounts of information to be communicated to the designer.

AREA REFERENCES

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RELATED PROGRAM AREAS

Other Communication Modalities and Usability and User-Centered Design.

POTENTIAL RELATED PROJECTS

Unknown.