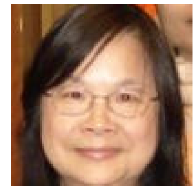
Dr. Susanna Wei, Associate Professor
Computer Graphics



B.A., University of Wisconsin
M.S., University of Wisconsin
M.S.E., University of Pennsylvania
Ph.D., University of Pennsylvania

Research Statement

My research in computer graphics can be divided into two areas. One is computer graphics human figure modeling and simulation, and another is scientific visualization.

My interest in computer graphics human figure modeling and simulation began when I conducted my Ph.D. dissertation research at the University of Pennsylvania. Because of my expertise in this highly specialized area, I was invited to continue to help research at the Center for Human Modeling and Simulation at the University of Pennsylvania even after I joined the faculty at Saint Joseph's University.

An important research aim of the Center is to create an interactive and intelligent virtual human model. This goal was achieved in the development of the Jack System. This system has involved experts from the fields of computer science, computer graphics, biomechanics, robotics, psychology, physiology, and cognitive science.

My many contributions to the Jack system include developing the Strength Display System, creating the Posture Interpolation System, and obtaining and verifying suitable human strength data vital to strength-related projects such as motion planning, strength-guided motion, human locomotion, human reach trajectories, and collision avoidance. As a Jack system team member, I also developed, with Richard Quach, the Spreadsheet of Anthropometric Scaling System (SASS). The SASS is a spreadsheet system which allows flexible, interactive access to all anthropometric variables needed to define a computer-based human figure. As an ongoing project, I have been working with researchers at the Center to continually update and add features to SASS.

Visualizing the torque load and the strength available on different joints is very important in human factors analysis. To facilitate this, I have developed an interactive display system that allows a user to show, graphically, the required torque and available strength on different joints for a given task. This system provides an indispensable visual aid which can assist a human factors designer in determining the feasibility of a given task under a given body posture. Because of their significance, two of my display methods have been selected for illustration in the book, Visual Cues: Practical Data Visualization, by P.R. Keller and M.M. Keller.

Body postures also form a very important aspect of human figure simulation. Static postures such as sitting, standing, lying supine, or lying prone can be defined by the relative positioning of various parts of the body. The realistic simulation of human motions requires advanced animation between these static postures. To satisfy this need, I have worked with a University of Pennsylvania Ph.D. student, Rama Bindiganaval, on research that uses a finite state machine to control the reasonable behavioral transitions from any starting posture to a goal posture by finding the shortest path of the required predetermined motion sequences between the two. Unlike the standard techniques of key-frame animations, this posture transition system can, and has been successfully implemented for simulating the transitions between different key postures (such as Standing Stowed, Standing Fire, Kneeing Stowed, or Kneeling Fire) of an animated soldier. We are now working on generalizing this posture interpolation for any anthropometric figure.

This human figure research is supported by ARO grants which provide me with course releases and some travel expenses. In addition, they allow partial funding for the Department to buy personal computers, hard disks, and an industry-standard graphics software package, the Application Visualization System (AVS).

Being extremely active in current research helps me to stay on the top of what is going on in my field. More importantly, since my knowledge of the field is increased, my research helps me become a better teacher. Also, through the use of a very powerful and versatile graphics software package, AVS, I have been able to involve some of my undergraduate and graduate students in a variety of projects in my other research interest, scientific visualization.

In my research on scientific visualization, I have studied various display methods to examine different aspects of statistical data. I have also developed an animation program, Reaction Viewer, which enables chemists to visualize chemical reactions dynamically. This program can be used not only to simply watch a chemical reaction occur, but also to observe how the complex electronic properties of a molecule change during the course of a reaction. Reaction Viewer is especially pertinent when one is interested in how electrons migrate during the progression from reactants to products, or examining how chemical bonds are redefined during the course of a reaction.