A NATIONAL SCIENCE FOUNDATION
ENGINEERING RESEARCH CENTER

application
research
projects

Full-Hand Cyber Grasp

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Research Goal

- Design and implement a new type of haptic device with realistic feeling of grasp, applicable to all finger segments (phalanges) and palm -- as opposed to finger-tips only, as is in the best systems currently available
- Real-time human hand modeling based on actual hand position and motion data
- Real-time collision detection and force feedback calculation

Role in IMSC

- Haptics systems are instrumental for various modes of communication, training, and tele-control
- Because of its superior performance the new system is likely to bring new applications to the realm of haptics
- The system may be effectively integrated with other IMSC research

Research Approach

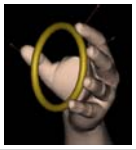
- A Novel hardware design
  - Force exertion using independent and variable position linkage to an exoskeleton structure
  - High frequency response
- Anatomical model of human hand
  - Articulated hand model with 20 degrees of freedom for fingers and 6 degrees of freedom for hand
  - Motion constraints and joint dependencies to accurately reconstruct hand motions

Accomplishments

- Two hardware design concepts have been developed and tested
- A prototype hardware system has been made operational
- The human hand model software, which is capable of force feedback computation, has been completed and successfully integrated with the hardware

Uniqueness & Related Work

- **Uniqueness**
  - Has maximum number of force pressure points for force feedback
  - Capability to generate realistic feeling of grasp for various geometric objects
  - Does not create fictitious force
- **Related Work**
  - Numerous work in human hand modeling, animation, and haptic rendering algorithms



5-Year Plan

- Prototype redesign and implementation with detail ergonomics considerations
- Performance evaluation using various subjects in an experimental design setting
- Performance evaluation in specific realistic applications
- New application development