Simulating Reach Motions

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Modeling normal human reach behavior is dependent on many factors. Anthropometry, age, gender, joint mobility and muscle strength are a few such factors related to the individual being modeled. Reach locations, seat configurations, and tool weights are a few other task factors that can affect dynamic reach postures.

This paper describes how two different modeling approaches are being used to predict normal seated reaching motions. One type of model uses an inverse kinematic structure with an optimization procedure that minimizes the weighted sum of the instantaneous velocity of each body segment. The second model employs a new functional regression technique to fit polynomial equations to the angular displacements of each body segment.

To develop and validate these models, 38 subjects of widely varying age and anthropology were asked to perform reaching motions while seated in a driving simulator. Seventy-eight reaches were required of each subject, for a total of over 3000 reaches. During these motions a Qualysis Motion Capture system was used to record the movements of each person's torso, shoulders, arm, forearm and hand.

The paper discusses how the models differ in construction and performance. Software will be used to demonstrate how human reach motions can be synthesized for vehicle interior design analysis, and how biomechanical models can be linked to the new kinematic models for ergonomic evaluation.

A description of current research on human motion simulations at the University of Michigan's HUMOSIM Laboratory also will be included.

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