Simulating Complex Manual Handling Motions via Motion Modification: Performance Evaluation of Motion Modification Algorithm

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Simulation of human motions in virtual environments is an essential component of human CAD (Computer-aided Design) systems. In our earlier SAE papers, we introduced a novel motion simulation approach termed Memory-based Motion Simulation (MBMS). MBMS utilizes existing motion databases and predicts novel motions by modifying existing 'root' motions through the use of the motion modification algorithm. MBMS overcomes some limitations of existing motion simulation models, as 1) it simulates different types of motions on a single, unified framework, 2) it simulates motions based on alternative movement techniques, and 3) like real humans, it can learn new movement skills continually over time. The current study evaluates the prediction accuracy of MBMS to prove its utility as a predictive tool for computer-aided ergonomics. A total of 627 whole-body one-handed load transfer motions predicted by the algorithm are compared with actual human motions obtained in a motion capture experiment. Computed prediction errors were compared to estimates of inherent variability in human motions. The results indicated that the motion modification algorithm can predict 3D whole-body motions accurately with errors that approximate the inherent variability of human motions.