Integration of Magnetic and Optical Motion Tracking Devices for Capturing Human Motion Data


For dynamic biomechanical analyses or development of human motion simulation models, it is important to establish an empirical motion database derived from efficient measurement and well-standardized data processing methodologies. This paper describes the motion recording and data processing system developed for modeling seated reach motions at the University of Michigan's HUMOSIM Laboratory.

Both electromagnetic (Flock of Birds) and optical (McReflex) motion capture systems are being used simultaneously to record the motion data. Using both types of devices provides a robust means to record human motion, but each has different limitations and advantages. The amount of kinematic information, spatial range of measurement, external sources of noise, motion tracking time, and setup cost are key differences. Although there are reports on the use of each of the devices separately in studying human movement, to our knowledge, no research has been reported wherein both devices were simultaneously used. To meet our research goals, we believed there were advantages by combining the two devices.

A protocol of placing the electromagnetic receivers and optical markers was developed based on a kinematic linkage definition of seated operator. It was the goal to provide the kinematics of seated reach motion as a set of global and local joint angles, from data provided by the two devices. A technique to correct errors in placing the electromagnetic receivers was developed, which uses initial standardized postures. A simulator was built, in which typical industrial and in-vehicle reach activities can be simulated. The simulator was designed so that various reach motions can be recorded with minimal sources of external noise. In order to synchronize the two data streams, as well as define a common coordinate system, an analysis of sample motion data was conducted, and a post-hoc synchronization method was developed. Results are presented that indicate the reliability and efficiency of the combined system. This paper also briefly describes joint center estimation and angle calculation methods using the Transom Jack software.

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