

A Tool/Part/Human Interaction Model for Assembly in Virtual Environment

ABSTRACT: Current virtual assembly environments primarily allow assembly operations involving pick and place manipulations with hands. In some applications, assembly tools snap onto screws and are constrained. Some non-immersive systems create tool motion script models for the tool to execute the assembly operation. The inclusion of tools and realistic tool operations is a significant step in creating a better virtual assembly environment. We propose a technique to model hand held tools and the corresponding assembly operations in a virtual environment. Intermediate-location constraints and tool engagement constraints obtained from the CAD model are used to model the intermediate positions and engagements of a fastener tool, tool-part, and base-part. In addition, tool-based motion dependent on the rotation of the tool and the pitch of the thread has been achieved for a fastener part. This allows us to simulate the physical reality of these interactions without using expensive collide, penetrate, correct, and align methods. The tools and tool/hand/part interactions have been modeled and tested in a virtual assembly and design environment successfully. This capability also allows tool accessibility and tool operability to be verified.