

Embedding Haptics-Enabled Virtual Tools in CAD for Training Applications

Abstract: This paper describes recent work completed to provide haptics-enabled virtual tools in a native CAD environment, such as CATIA V5™. This was a collaborative effort between Washington State University, Sandia National Laboratories, and Immersion Technologies. The intent was to start by utilizing Immersion's Haptic Workstation™ hardware and supporting CATIA V5™ software at Sandia and leverage the existing work on virtual assembly done by the VRCIM laboratory at Washington State University (WSU). The key contribution of this paper is a unique capability to perform interactive assembly and disassembly simulations in a native Computer Aided Design (CAD) environment using tools such as allen and box-end wrenches with force feedback using a cyberforce™ and cybergrasp™. Equally important, it also contributes to the new trend in the integration of various commercial-off-the-shelf (COTS) systems with specific user driven systems and solutions using component-based software design concepts.

We discuss some of the key approaches and concepts including: different approaches to integrating the native CAD assembly data with the virtual environment constraints data; integration of the native CAD kinematics capability with the immersive environment; algorithms to dynamically organize the assembly constraints for use in manipulation with a virtual hand for assembly and disassembly simulations; and an event-callback mechanism in which different events and callback functions were designed and implemented to simulate different situations in the virtual environment. This integrated capability of haptic tools in a native CAD environment provides functionality beyond extracting data from a CAD model and using it in a virtual environment.