

# An Open Architecture For Embedding VR-Based Mechanical Tools Into Cad Applications

**ABSTRACT:** Virtual Reality (VR)-based assembly and disassembly analysis systems have been in use for several years. There have also been various efforts at creating bi-directional integration between CAD systems and VR-based assembly systems. The next step in this integration is to provide the capabilities of CAD and the immersive systems under one umbrella. This paper presents an open/extensible architecture for embedding VR-based mechanical tools within CAD systems to assist in assembly and disassembly analyses. The goal is to allow the user to perform immersive assembly/disassembly evaluations entirely within the CAD system. The architecture discussed in this paper is designed to leverage the inherent visualization and modeling capabilities provided by any commercial CAD system, while allowing the user to use any level of immersion ranging from simple tracking and stereo visualization to complete haptics devices. The focus is on providing assembly and disassembly capabilities using mechanical tools (e.g. wrenches, screwdrivers, etc.). The architecture is designed to be open (generic) for easy adaptation with any CAD system (through the API of the CAD system) and any haptic device (through the API of the haptic device). It provides a template consisting of modules and classes, which are relevant irrespective of the choice of the CAD system or the haptics system. The architecture is also designed to be extensible to include advanced interactions and simulations beyond the basic capabilities implemented in the system described in this paper. The CAD model library structure is leveraged for managing virtual tools and fasteners available to the user. The proposed architecture has been implemented to provide virtual assembly functionality within CATIA V5 using the VirtualHand™ Toolkit from Immersion Corporation. Examples of this implementation using threaded fasteners and tools are also presented. The extensibility of the architecture was tested by implementing a different suite of mechanical tools for a different simulation purpose.