AN XML-BASED DIGITAL MOCK-UP SYSTEM FOR HETEROGENEOUS ASSEMBLY

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ABSTRACT
Digital Mock-Up(DMU) system, a tool to build a virtual mock-up in the design stage, has been used to prevent interferences and mismatches during precision design processes. Using the virtual assembly tool, engineers are able to design precision and interference free parts without making physical mock-ups. Instead of a single CAD source, several CAD systems are used to design a complex product in the distributed design environment. In this paper, a heterogeneous multi-CAD assembly method is proposed through an XML and the lightweight CAD file. XML data contains hierarchy of the heterogeneous multi-CAD assembly. The lightweight CAD file produced from various CAD files through ACIS kernel and InterOp includes not only mesh and B-Rep data, but also topological data. It is used to visualize CAD data and to verify dimensions. The developed system is executed on desktop computers. It does not require commercial CAD systems to visualize 3D assembly data. Assembly of heterogeneous models is conducted to verify the effectiveness of the developed DMU system on the Internet.

KEYWORDS
Assembly, Digital Mockup, Heterogeneous CAD, lightweight CAD file, XML

INTRODUCTION
Design of cars and aircrafts requires a lot of engineering collaborators. Most of design modifications, related to manufacturability and assembly, are required due to mismatches and interferences between neighboring parts. To reduce such mismatches and interferences, a real mock-up has been used. CAD systems are applied to verify and check the assembly process. DMU systems have been used to prevent the interferences and miss matches during precision design processes. Using DMU systems, designers are able to design precision and interference free parts without making physical mock-ups.

Rezayat\cite{1} has applied XML to exchange CAD information. In order to exchange CAD data, Rezayat translated topological CAD information into XML data by using KBPD(Knowledge-Based Product Development). In addition, he proposed a DTD type schema called CADML(CAD Markup Language). Chen et al.\cite{2} studied a real-time web-based collaborative design for assembly, which is called e-Assembly. By using ACIS kernel and the model of CAR (collaborative assembly representation), they devised a real-time collaborative tool applicable to verifying assemblies. Jeze rnik and Hren\cite{3} developed a low cost VR(virtual reality) system by using XML and VRML. JT of UGS\cite{4} and HSF of HOOPS\cite{5} visualize assembled parts composed of heterogeneous CAD data. However, they do not generate visual data efficiently in various PDM systems because they are not interfaced with XML or STEP/PDM schema.

In this paper, visualization of an XML based DMU system for assembled parts composed of heterogeneous Multi-CAD data is proposed through the visualization of the lightweight CAD file \cite{6}. The developed system does not require expensive commercial CAD systems. Cost of ownership is cheaper than other systems. In addition, the system has a function of real-time interference check, dimensional check, and design verification of heterogeneous multi-CAD assembled parts on the Internet environment. Lightweight CAD data \cite{6} are used for sharing model information. XML is used for displaying and interfacing BOM (bill of material) of assembled parts. By designing a schema based on an international standard of ISO/STEP PDM,