

CAD Model Assembly Hierarchy Reorganization for Application in Virtual Assembly: A Hybrid Approach Using the CAD System and a Visualization Tool

ABSTRACT: The hierarchy of assembly components in a CAD assembly model is rarely a true representation of the sequence of assembly of these components during manufacturing. Thus, any assembly planning or evaluation software system needs to re-order and re-group the various components of the CAD assembly model to reflect the sequence of component assembly. Although all parametric CAD systems allow reorganization of the assembly tree, it is a difficult and timeconsuming process due to the relationships and constraints between the various components. We propose an alternative hybrid method that couples the CAD system and a visualization tool that supports reorganization, while preserving data, to allow fast and easy rearranging of the assembly hierarchy. Also, after the reorganization, polygonal representations of the new sub-assemblies are created and the original constraints are also transformed in a consistent manner. As a next logical step, we compare the time required to rearrange the assembly hierarchy using both methods — the CAD system alone and the hybrid system. A statistical analysis using three treatment factors indicates that if the number of components is more than 15, then it is more efficient to use the hybrid method over the CAD system. The overarching goal was to allow fast and efficient creation of different assembly hierarchies to allow the corresponding assembly sequences to be verified in a virtual assembly application that derives its models and constraints from the assembly hierarchy in the CAD system. We have implemented the method to allow the successful reorganization and virtual assembly verification of many industry models, some with several hundred components, provided by various industry partners.