A DISTRIBUTED SIMULATION ENVIRONMENT BASED ON "GLUING ALGORITHMS"

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As the need for cooperation increases among dispersed groups within an organization, the need for distributed design and simulation technology has arisen. Independent of simulation, automobile manufacturers are operating in a way that distributes the production processes with multi-layered supply chains. Even within a supplier unit, it has become a common practice that different groups work on different components of the product. Hence, there is a great need on developing methodologies that can be exploited to simulate mechanical system whose models are distributed amongst disparate production units. Such methodologies should fulfill the following requirements: 1) Integrate different models and software codes in a plug-and-play manner; 2) Communicate across distributed computing resources; 3) Maintain the integrity (independence) of the separated component models.

This presentation summarizes our research towards a distributed simulation environment that meets the challenges of the distributed cooperation. Our efforts are focused in three directions. First, a gluing algorithm was developed, denoted as the T-T method, which enables distributed simulation models to be coupled while maintaining the independence (integrity) of the separate component models. Second, we developed a general and efficient model description for simulation, using XML. Each model is described with a XML file and stored in model database. New integrated models can be assembled based on these model descriptions. Simulation of a model is started by simply sending its description to the simulation server. Third, we worked on the design of a logical distributed architecture that can be implemented with one of the existing distributed technologies. Also, interfaces between different network components have been standardized to enable the extensibility of the architecture. These efforts have been combined into a prototype distributed simulation system that demonstrates the potential for a distributed simulation environment that is based upon the use of gluing algorithms.

In this presentation, we will focus on the gluing algorithm, which is a major challenge of this research. The proposed gluing algorithm, the T-T method, can be used to integrate static, dynamic, and multibody dynamic component models of a mechanical system. It relies only on the interface information without requiring internal details of the subsystem models and maintains the integrity of subsystem models. Therefore, each component model is treated as a black box, and only minimal information at the interfaces are required. The component models are wrapped with simulation codes of either finite element or multibody dynamics, and then plugged into the integration system. The simulation can be done through (demonstration) web pages by simple point and click manipulations.