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Model-Integrated Mechatronics – Toward a new Paradigm in the Development of Manufacturing Systems

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Abstract

The traditional approach for the development of manufacturing systems considers the constituent parts of the system, i.e., mechanical, electronic and software, to be developed independently and then integrated to form the final system. This approach is being criticized as inappropriate for the complexity and the dynamics of today's systems. This paper proposes an architecture that promotes model integration not only for implementation space artifacts but also in artifacts of the early analysis and design phases of the development process. The proposed architecture, which promotes reuse and significantly decreases development and validation time, is at the heart of a new paradigm called Model Integrated Mechatronics (MIM). MIM applies domain-specific modeling languages for the concurrent engineering of mechanical, electronic and software components of mechatronic systems. It simplifies the integrated development process of manufacturing systems by using as basic construct the Mechatronic Component. The MIM paradigm was utilized to define "Archimedes," a system platform that supports the engineer through a methodology, a framework and a set of tools to automate the development process of agile mechatronic manufacturing systems.

Index Terms--Mechatronic systems, design methodology, mechatronic component, model driven development, modeling, model integration, model evolution.