Embedded Systems Design for Industry 4.0

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Abstract – Applications for Industry 4.0 face new challenges in the design of embedded systems. The increasing functional density requires a flexible design process to achieve a competitive time to market. Given the tight goals today, the key technologies to success are: reuse of modules, highly abstracted functional models, parallel hardware/software development, virtual prototypes, etc.

Specification Phase
- Tool based requirements engineering
- SystemC as a formal specification and modelling language
- Executable specification at a high abstraction level
- Models are used as virtual prototypes

Verification
- Specification- and design-errors have to be detected as early as possible
- Enhanced verification effort during design phase
- Simulation based methods evaluate the confidence
- Formal methods result in a mathematical proof
- Verification refinement from highly abstracted to netlist verification and software test processes

Architecture Exploration
- Specified functions are mapped either to hard- or software modules
- Profiling and estimation methods to evaluate the properties of an architecture
- Design space exploration processes

Hardware Development
- Refinement of abstract SystemC models
- Cycle accurate model in VHDL
- Synthesis processes
- Verification against the given specification

Software Development
- Operating System for memory management, task scheduling, communication, user interfaces, etc.
- Hardware abstraction layer
- Software testing procedures

Deployment, Prototype Implementation, and Product
- Deployment to appropriate evaluation boards in a lab environment
- Hardware test, performance analysis, endurance test, usability test, etc.
- Prototype implementation in an industrial environment
- Product finalization and technical customer support