Mechatronics Process Management

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Agenda

- Introduction

- Mechatronics Data Model: Single Source of Product Knowledge

- Best-in-class Tools and Tool Integrations

- Cross-domain Design Collaboration

- Live Presentation

- Summary
A Mechatronics system is the synergistic integration of electrical, software, electronics and mechanical technologies into electro-mechanical products.
Why Mechatronics?

Improve Time To Market through integration of mechanical, electrical and software domains

Reduced cost of ‘software campaigns’ by the ability to manage product lifecycle of software

Reduce physical prototypes and earlier validation in lifecycle by ability to perform electro-mechanical system design simulation and analysis
Challenges

Cross-functional knowledge
- Interdependence of software, electronic, control and mechanical components

Implementing integrated solution
- Different domains, tools, data and terminology

Dispersed design teams
- Communication and optimization across disciplines

System view and modeling
- Requirement allocations across entire BOM
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Teamcenter Whole Product Management
Cross-discipline design management

Provides a Single Source of Product & Process Knowledge

Concurrent Engineering

Product level
Multi Discipline Alllocations
Revisions & Configurations
Native Data
Collaboration formats

ECAD
MCAD
Electrical
SW

Schematic
PCB layout
Drawings
CAD
Schematic
Physical
Source
Binary

Concept
Planning
As Designed
As Built

Change Management
Configuration
PLM Open
Collaboration

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Siemens PLM Software
Typical Design Environment
Multiple domains, tools, databases, versions …
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Structured workflow and change management
Managed Multi-CAD design

- NX, Catia, Pro-E, SolidWorks, SolidEdge, Inventor, ...

- Industrial design and styling
- Photo-realistic rendering
- Design layout and product modeling
- Detail design, tooling, and documentation
- Product and process templates
Best-in-Class Tools and Tool Integrations
Electronics Design Lifecycle Management

ECAD tool support
- Embedded ECAD integrations
- Gateway integration for EDA

EDA parts library
- Enterprise-wide library management
- Facilitates part standardization & environmental compliance

Manage data in Teamcenter
- Provides uniform ECAD data management
- Facilitates associativity that links design objects
Integration with popular ECAD logic capture and physical layout tools

Embedded integrations
- ECAD tool user interface
- Cadence: Allegro, OrCAD
- Mentor: Board Station, PADS, Expedition
- Altium: Designer
- Intercept: Pantheon

Gateway-based EDA integrations
- Window-base, menu driven application interface
- Custom tool integration
Best-in-Class Tools and Tool Integrations
ECAD Parts Library Management

Enterprise-wide parts library management
- Provides a single source of electronic part information
- Supports multiple ECAD tool libraries
- Manages footprints and symbols

Standardization and compliance
- RosettaNet classification support
- Define part status and attributes
- Control part selection, change and approval process
- Track vendor/commercial parts
- Link to part supplier management
- Verify environmental compliance
Best-in-Class Tools and Tool Integrations
Electrical Interconnect / Wire Harness Lifecycle Mgmt

Third party schematic capture
- Logic design
- Component properties

Teamcenter (PLM)
- Manages logic and layout data
- Supports selected STEP AP212 and KBL data
- Manages option and variants

NX (CAD)
- Physical design and attributes
- Design rule validation and interferences
- Visualization and BOM generation
Best-in-Class Tools and Tool Integrations
Source Code Development

Accelerate software development and improve its quality
- Tie product requirements to software projects
- Establish structured software development workflows
- Develop source code in a native development environment
- Access ClearCase metadata in PLM
- Manage software as part of your product configuration
Best-in-Class Tools and Tool Integrations
Embedded Software Manager

Treat software binaries as a “Part”
- Trace defects from binaries back to requirements
- Integrate SW into product workflows
- Establish change mgmt processes
- Ensure correct binaries are provided to flashing station

Manage electronic network’s messages and signals

Dependency Management; Signals, SW to SW, SW to ECU & ECU to ECU
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Cross Domain Design Collaboration

Typical Issues

- Isolated groups with different terminology and design context

- Physical prototypes required to verify integration issues

- Late discovery of fabrication and assembly
Cross Domain Design Collaboration

Benefits

- Prevent design errors and schedule delays
  - Context familiar format
  - Share data across domains

- Increase product quality and reliability
  - Analyze design early
  - Optimize in a virtual world

- Reduce scrap and rework
  - Validate for multiple facilities
  - Identify issues early
Cross Domain Design Collaboration
Share Data Across Domains

Visual collaboration in context
- Query and investigate design from a familiar context
- View data from multiple tools
- Search and navigate the design
- Mark-up issues with language specific standard annotations

Compress verification and debug time
- View, highlight and cross-probe schematic and PCB layout
- Capture and share required changes for faster release

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Cross Domain Design Collaboration
Analyze and Optimize in a Virtual World

ECAD and MCAD data exchange
- PCB.Exchange based on IDF
- Pass 2.5D/3D information
- Share configuration and design constrains

Generate fewer physical prototypes
- Check assembly clearances
- Perform package related simulation and analysis

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Cross Domain Collaboration
Identify Design and Manufacturing Issues Early

Design for Assembly
- PCB assembly rule analysis
- User-configurable parameters
- Graphical display of violations
- Multiple measurement and investigation utilities

Reduce scrap, cost and rework
- Identify assembly issues early
- Reduce manufacturing costs
- Shorten pre-production set-up
- Ensure assembly across multiple facilities
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Mechatronics Process Management
Overview (Tools)

ECAD
- Schema
- Manufacturing

PCB
- IDF

SOFTWARE
- Source Code: C#/C/C++, VB, Delphi, ...
- Binary

MCAD
- IDF
- PLMXML AP212

WIRE HARNESS

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Siemens PLM Software
Live Presentation...
Use Case Scenario
Mechanic, Electronic and Electric

Mechanical Engineer
NX (CAD)
- Search Bi-Fuel motor controller
- Open assembly

Electronical Engineer
Cadence Allegro (E-CAD)
- Open schematic & PCB
- Generate IDF
- Generate manufact.
- Generate viewables

Electrical Engineer
(EL-CAD)
- Wire harness (schematic)

Mechanical Engineer
TEAMCENTER (PLM)
- BOM (CAD) in Teamcenter

Electronical Engineer
TEAMCENTER (PLM)
- BOM (E-CAD) in Teamcenter
- Show viewables
- Cross probing

Electrical Engineer
TEAMCENTER (PLM)
- BOM, wire harness in Teamcenter
  (length, preview)
Use Case Scenario
Mechanic and Software

Mechanical Engineer NX (CAD)
- Import IDF into NX (some components already exists)

Mechanical Engineer TEAMCENTER (PLM)
- BOM, PCB in Teamcenter with JT files

Mechanical Engineer NX (CAD)
- Wire harness

Mechanical Engineer TEAMCENTER (PLM)
- BOM, wire harness in Teamcenter (length, preview)

Software Engineer (IBM ClearCase)
- Binary files

Mechanical Engineer TEAMCENTER (PLM)
- Show relations between uCPU & software
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Teamcenter Mechatronics Process Management

- Mechatronics data model: single source of product knowledge
- Requirements and mechatronics associativity
- Best-in-class tools and integrations
- Cross-domain design collaboration

**Challenge:** Manage requirements process for program involving mechanical & electronic systems

**Solution:** Implement database to automate requirements process

**Result:** Improvements to competitive bid process lower cost, enhanced quality
Virtual prototyping of assemblies with in-context electronic, electrical & mechanical design
- Associative ECAD data exchange
- Automated PCB modeling
- Rules-based electrical routing & wire harness design

Challenge: Unify development among 14 global facilities

Solution: Implement design system for global drawing, BOM & change management

Result: On track for 30% cost and time-to-market reductions
Summary

**Mechatronics**

- Electrical / Wire Harness Lifecycle Management – Bring electrical & mechanical interconnectivity together
- Systems Engineering – Manage the complexity of architecture, function, logic, and implementation
- Electronic Design Collaboration - Bring the electrical and mechanical teams together – visually
- Software Lifecycle Management - Manage S/W with the rest of the product
- Single Source of Product & Process Knowledge - Manage all product data in a single environment
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Thank You