Customizing STAR-CCM+ for Seamless Integration to Product Lifecycle Management Environments

Thomas Walker, CD-adapco
Brief Summary of PLM

Talk about the Current Challenges to Automation in the Automotive Industry

Talk about why CFD and PLM make great partners to overcome these challenges

Why meta-data can be a game changer for your workflow

What PLM integration features exist in STAR-CCM+

How Customization (Java!) can fill in the blanks

Why EFFECTIVE Post Processing is so important and how XML can help.

How CD-adapco’s Custom Tools Group has already demonstrated all of these concepts, with examples.

Questions
What is Product Lifecycle Management?

Product Lifecycle Management (PLM) is the process of managing the entire lifecycle of a product from its conception, through design, analysis, and manufacture, to service, and disposal.

In many industries, and particularly in the automotive industry, PLM is the backbone of how information about a product moves around inside a company.
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Why? What do CFD departments benefit from integrating more closely with PLM. How does the Company benefit?

How does STAR-CCM+ fit into this?
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- The Demand for a shorter development process.
- The Demand for less physical prototypes.
- The Demand for simulation results to make design and development decisions.
- The Need to handle large amounts of post processing results and getting the correct people the results as quickly as possible.
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  - Digital Assessment
  - Digital and Hardware Assessment

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The most valuable aspect of PLM systems for CFD/CAE usage is by far XML!! (Extensible Markup Language)

XML lets you reference geometry that STAR-CCM+ can import, but also describe the data in ways that are really advantageous for automation.

STAR-CCM+ currently supports importing 2 different types of XML schema. Most other schemae can be modified through some customization coding to read into STAR-CCM+.

How do you import an XML file?
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Now that you imported XML, Use that Meta-Data!
The sky is the limit with Meta-Data.

PLM Systems may not have everything you need (most are not CAE focused)

Customization starts here!

Add CAE Specific Information: Material Properties, etc.

During the workflow, you can add meta-data that can be referenced later in the process or exported to update a PLM system.
Now that you imported XML, Use that Meta-Data!

The sky is the limit with Meta-Data.
PLM Integration Overview
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PLM XML Data

Tabular Input via GUI

API to STAR-CCM+

Import from Neutral Format

Export to Neutral Format

Domain, Type
Vehicle, Fluid
Radiator, HX
Fan, MRF

Image Posting Tasks
Reporting Tasks

API from STAR-CCM+

API to STAR-CCM+
How to Export XML from STAR-CCM+
How to Export XML from STAR-CCM+
Challenges for Full Vehicle Thermal Simulations

- To Mesh Thousands of Parts

- Allocation of Material Properties for all parts

- To guarantee that each part is properly defined.
Utilize XML

Leverage the Product Structure to your advantage

Your PLM system may already have enough information to automatically categorize your parts.
STAR-CCM+ Batch Process based on Customization Modules

- Creates batch process to volume mesh each part.
- Multiple meshing methods are used based on XML and knowledge of the product structure.
POST PROCESSING
DESIGN ITERATION #631

DATE 1 JULY 2012
CLIENT SIMDRIVEN MOTORS INC.
Automated **EFFECTIVE** Post Processing and Reporting

- Create automated post processing with a maximum effect for the designers and system engineers.
- Create reports with click-through investigations.
- Focus your results to the people that need it most.
- Provide information for who is responsible for the current parts.

Automatic VTM Post Processing with Sensor Points Recommendations

Design Engineer (and/or Dept.) can receive an email with latest results as they happen...

BiwComponentTemperatures
XML Can Contain Material and Critical Temperatures

- Create personalized XLS sheets that can be emailed to the correct component groups based on the XML designation.

- The Material information in the XML can also provide critical temperatures.

- Highlight component parts that fail for easy identification.
Steel

Qrad[W]: 12.06
Qconv[W]: 45.00
Qcond[W]: -57.45
Tmin[°C]: 39.09
Tavg[°C]: 56.92
Tmax[°C]: 75.31
Tmax Location:[2.319, -0.286, 0.088]
How to use XML effectively to create a full VTM Analysis
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CAE

PLMXML

Tabular Data Customized Module for CFD Analysis

Solid Meshing Customized Module
(Creation of Solid Model and Apply Material Properties)

STAR-CCM+ Custom Tool made by CD-adapco
How to use XML effectively to create a full VTM Analysis

STAR-CCM+ Custom Tool made by CD-adapco
STAR-CCM+ “sim” File

Solid Meshing Customized Module (Creation of Solid Model and Apply Material Properties)

VTM Solid Model of Entire Vehicle

CFD/Flow Model

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PLMXXML

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- **Co-Simulation Customized Module**
- **CFD/Flow Model**
- **Tabular Data Customized Module for CFD Analysis**
- **PLMXML**
- **CAE**

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Thank You!

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