Real Time Model and Simulator for Industrial Gas Turbines

Results from OPENPROD Project

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Agenda

- The Gas Turbine Simulator
- Gas Turbines – Product Modeling Concept
- Summary & Conclusions
The Gas Turbine Simulator

- The model is built by using Modelica (Dymola)
- Siemens Simatic PCS7 is used as controller
- Some parameters are simulated in Simatic, lubrication oil temp...
- Signal exchange
  - Modelica -> Simatic (12 signals)
  - Simatic -> Modelica (8 signals)
- Communication Modelica – Simatic: OLE for Process Control (OPC)
The Simulation Concept
The Simulator Equipment
The Real Time Model – Speed Challenges

- Simplified compressor and turbine characteristics
- Simplified gas control valves
- Old slow functions replaced by faster Modelica standard functions
- “Unnecessary” calculations/functions removed
- Removal of leakage flows
- Reduced number of cooling flows
Simplification of the Standard Model

- Reduced number of cooling flows
- Removal of leakage flows
Applications for the Gas Turbine Simulator

- Control department – Test of new controllers/control concepts
- Performance department – Transient behavior when the real control is important
- Education for new employees
- Training for operators/commissioners
- Etc…
OPENPROD – Solution Concept

1. Information Model
2. Collaboration Platform

Attribute 1
Attribute 2
Attribute 3
Attribute 4
Attribute 5
Attribute 6
Attribute 7
Attribute 8
Attribute 9
Attribute 10
Attribute 11
Attribute 12
Attribute 13
Attribute 14
Attribute 15
Attribute 16
Attribute 17

Mats
Ingvil

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Information Model Coverage - The Gas Turbine Portfolio
Consolidated Information for Design and Simulation

Requirement Root → 5 psig
Function Root → Increase Pressure Function
System Root → Increase Pressure System
Assembly Root → Pump Component

Simulation, e.g., Modelica
Verification
Behavior
Operational condition
Component characteristics
OPENPROD – Demonstrators, Package verification

Lifecycle control
- Customer needs
- Formalized requirements
- Functions and requirements
- Simulation parameters
- Simulation result presentation

Design & simulation cycle control
- TC
- SAs
- COMOS
- Siemens Modelica Library
- Open Modelica
- Formalized requirements
- Functions and requirements
Summary & Lessons learned from OPENPROD Demonstrators

Modelica:

- Dynamic Modeling ➔ A lot of possibilities!

Product Information Modeling using UML:

- Information and Product Modeling ➔ Fundamental Methodology

- “Information Hub” Concepts ➔ A way of business integration

- Semantic Plug&Play System Application Architecture ➔ Flexibility and Speed

- Existing International Standards ➔ Communication between IT environments