Plant Modeling Made Easy

21 January 2019

Evangelia Papadopoulos
Proposals Manager
Topics

• History of L3 MAPPS’ Graphical Modeling Environment
• Orchid® Simulation Environment Overview
• Orchid® Modeling Environment
  – General/Unique Features
  – Configuration Control Features
  – Configuration Management Features
• Conclusions
History of L3 MAPPS’ Graphical Modeling Environment
History of L3 MAPPS’ Graphical Modeling Environment

• 1991
  – L3 MAPPS (formerly a division of CAE) launched first graphical, object-based modeling environment named ROSE® (Real-time Object-oriented Simulation Environment)

• 1992
  – L3 MAPPS is recognized by SCS (Society for Modeling & Simulation International™) for significant value added to simulation industry

• 2007
  – L3 MAPPS introduces Orchid® suite, including Orchid® Modeling Environment based on ROSE®

• Today
  – Orchid® Modeling Environment is most mature and stable graphical models creation tool featuring rich configuration control/management features
Orchid® Simulation Environment Overview
Overview

• Real-time simulation based on first-principle models
• Graphical icon-based model editor
• Intuitive “Drag-Drop-Connect” model development
• Object-oriented design with automated code generation
• Standardized modeling
  – Guaranteed uniformity of code
  – Guaranteed uniformity of simulation depth
• No coding knowledge required
• Model details are all visible
• Visually similar to engineering drawings
Client/Server Architecture

- Software architecture supports a scalable, flexible hardware architecture
  - Client/server application designed for collaborative work
  - Allows dozens of users (or more) to work locally or in a distributed environment
- Centralized Microsoft SQL Server database
  - Contains all configuration items (sources) and their versions
    ▪ Schematics
    ▪ Object libraries
    ▪ Object instances
    ▪ Calibration
    ▪ Files (source code modules, subroutines, or any other configuration files)
  ▪ etc.
Basic Definitions

• **Object Library**
  – Group of objects

• **Object**
  – Model of a physical component (e.g. pump, breaker, relay, etc.)

• **Object Instance**
  – Instance of an object representing a specific equipment

• **Schematics**
  – Modeling diagrams (the model) typically based on plant drawings (P&IDs, EWDs, etc.)
Graphical High-Fidelity Models & User-Friendly Modeling Tools

- Complete object libraries representing typical plant equipment (e.g. pumps, pipes, breakers, etc.)
- Libraries and objects can be created/modified by partners and customers
- Object documentation generated on-the-fly
- Modeling made easy!
  - Drag objects from libraries to schematics
  - Interconnect objects by pointing & clicking in systems being modeled AND to/from external systems
  - Link to reference data sources (e.g. plant drawings, equipment data sheets, technical manuals, etc.) by pointing & clicking to associated data in SharePoint
  - Use online automated object calibrators to configure and fine tune objects/systems to reference plant
  - On-line PDF user manual
- Full visual, RUNTIME feedback (color and readout dynamics and real-time plant parameter monitoring and plotting) in Orchid® Modeling Environment AND Orchid® Instructor Station
- All object variables are accessible with on-the-fly calibration capabilities
- Browse between schematics from any system
- System documentation generated on-the-fly
Versatile Modeling

- Mature multi-discipline object libraries
- Single development environment for all model types (e.g. hydraulics, electrics, controls, etc.)
- Users can create/modify libraries/objects
Creating a Model

- Defining the scope of simulation
- Drag library components onto schematic
- Connect components according to engineering drawings
- Enter plant data for each component

- Enter plant data references
- Build configuration
- Testing/Validation
- Documentation
Object Calibration

• Object Calibrators
  – Calibrators built into the objects
  – Clearly identifies data required for calibration
  – Preview of calculated output before committing to database
  – Easily reconfigurable

• Object variable folders
  – Organize variables intuitively (input, output, physical constants, etc.)
Documentation

• Documentation for each object is generated on the fly
  – PDF created based on information in each object
  – Provides useful information on
    ▪ What the object is used for
    ▪ How to use the object
    ▪ Important variables
    ▪ How the object is modeled
Compound Objects

• Compound Objects
  – Deploy a thoroughly tested, complex simulation within a single library object
  – Encapsulate parent schematic requiring multiple objects (i.e. a macro)
  – Only interface variables are exposed
  – Abstract the complexity of control functions (a motor controller for example) that are used repetitively in a project
  – Compound object can be expanded during runtime
Runtime Features

- Visual dynamics (e.g. colors, shapes, etc.) based on system/component statuses
- Engineering readouts (e.g. pressure, temperature, current, voltage, etc.)
- Any simulator variables can be monitored
  - Resizable/Floating Data Logger Windows
  - Constants, calibration factors, instructor controls, or any other simulator variables can also be changed on the fly
- User-defined real-time plotting
- Orchid® Modeling Environment runtime graphics also available from Orchid® Instructor Station
Fully integrated *Graphical Models for the Whole Simulator Lifecycle*

- Development
- Testing/Validation
- Runtime/Maintenance

Hydraulic Systems
- Electrical Systems
- Instrumentation & Control Systems
- Interface to Conventional Models
Configuration Control/Management Considerations

• Reality
  – Data and software are very different and require different methods of identifying, managing and documenting changes
  – Data and software are strongly interrelated
  – Solution must be intuitive and integrated into the project workflow in a manner that is not only easy to use but also encourages its use
  – Typical source “code” control tools not designed for “graphical” model builders
  – Software development may be performed in geographically distributed, concurrent, collaborative environment
  – Data is likely to change over time

• Needs
  – Track the simulation design data and its use in the simulation software
  – Control and track changes to the simulation software among users

• Overall Result
  – Integrated, purpose-built solution that recognizes the difference between ‘data’ and ‘software’ control/management
Configuration Control/Management Main Features

• Configuration Entities
  – Versioning
  – Visual Compare
• Workspaces
• Tasks
• Data Tracking
• Data Referencing
Versioning of Configuration Entities

- Applies to configuration entities stored in the project database: schematics, libraries, files and configurations
- Check-in/check-out mechanism
  - An entity must be checked-out from a workspace to be modified
  - A checked-out entity is
    - Write-locked by the user
    - Cannot be modified by other users while it is checked-out
- The modified entities must be checked-in to be made available to other users
- A new version and revision history is created upon check-in
- The old versions are always available (roll-back capabilities)
• Compare Feature
  – Visual comparison feature for different versions of
    ▪ Workspaces
    ▪ Schematics
    ▪ Libraries
    ▪ Files
  – Highlight visual differences graphically
  – Highlight non-visual (e.g. calibration) differences in a list
  – Report generation
Workspace

- A user’s sandbox
- Virtual container holding references to specific versions of configuration entities
- Each workspace is an independent view of the project
- Allows users to work concurrently and efficiently without interfering with each other
Task

- Required to add, delete or modify workspace configuration entities
- Sub-container to make permanent changes to the project database
- Can be associated with a Change Request (CR) initiated in SharePoint (not mandatory)
- Changes made through a task become available to other users only when task is closed
Data Tracking
Data Referencing

Customer

- Customer supplied data can be referenced and tracked in Orchid® Modeling Environment at schematic [system] or object [component] level

- Live connection with SharePoint
  - In Orchid® Modeling Environment, users can browse, query or download any document in SharePoint
  - In Orchid® Modeling Environment, users can browse from a document to any schematic/object that references it
  - When a new version of an existing document is added to SharePoint, users referencing that document are warned of the change in Orchid® Modeling Environment

- Design data tracking can provide a snapshot of where customer data is used and which schematics and object instances are affected by data updates
Data Referencing Warning

- Identifies the configuration entities requiring attention when new data revisions are added to SharePoint
Conclusions

• L3 MAPPS pioneered object-oriented graphical modeling environment since late 1980s/early 1990s
• Orchid® Modeling Environment is part of the Orchid® suite, which includes all tools required to build, operate and maintain state-of-the-art simulators
• L3 MAPPS’ Orchid® Modeling Environment offers
  - Easy to use GUI
  - Mature object libraries
  - Rapid model development and integration
  - Standardized modeling approach
  - Features to develop, test, validate, run and maintain simulations
  - Well suited for small and large projects
  - Can be used in geographically distributed, concurrent, collaborative software development environment
Conclusions

• L3 MAPPS’ Orchid® Modeling Environment also offers
  - Robust and proven configuration control/management features designed for
    - Tracking and linking design/as-built data to simulation software (data traceability)
    - Controlling and tracking simulation software changes
    - Easily accounting for and identifying simulation configuration changes
    - Managing both graphical and non-graphical (conventional) models
Thank You

2019 Power Plant Simulation Conference
(PowerPlantSim’19)

L3 MAPPS
8565 Côte-de-Liesse
Montréal, Québec, Canada
H4T 1G5

Tel: +1 (514) 787-4999
Fax: +1 (514) 788-1442
Web: www.L3T.com/MAPPS
LinkedIn: L3 MAPPS