1

An interview with Aurel System's Larry Wasik on the past, present and future of CADSIM Plus developments

Larry Wasik is president of Aurel Systems Inc. He answered a few questions about the future direction of the company and its products and services.

Tell us a little bit about Aurel and its 25 year history with process simulation software.

In the early 80's I learned how to code MASS-BAL to balance processes for H.A. Simons, the consultant that I was working for at the time. But I became frustrated that most process engineers would never have the time to learn the specific skills required to do process simulation.

I had the idea that if you could make the interface more graphical (an engineer can draw a flowsheet) then balancing flowsheets could be done by any process engineer. So I took that idea to Tom Simons and he told me that times were slow for consulting, and that if I wanted to develop such a tool – independently – I should go for it. The original CADSIM as a graphical front-end for MASSBAL was the result.

I was really breaking new ground when I started CADSIM and since I was writing code for someone else's software (I couldn't change how MASSBAL worked) an independent program that interpreted a CAD drawing seemed to me to be the best approach. Later, other simulation companies changed their software to include graphics that in most cases simply documented the model's connections.

Little did I know at the time, interpretation of a drawing would give today's CADSIM Plus a big advantage over other products. Drawing interpretation allows the user to create a simulation drawing for presentation, including P&ID details, if required. And it provides the foundation for our truly intelligent "living drawings".

Developing computer-assisted design (CAD) software in the early 80's was a challenge. The speed and capacity of the personal computers of the day required an efficient and sometimes creative approach to code development. The resulting technologies included performance enhancements that allow today's CADSIM Plus to run a simulation thousands of times faster than real time, which is absolutely necessary for on-line applications that perform dynamic data reconciliation, optimization and control.

Later, when we developed the simulation engine for CADSIM Plus, the CAD graphics were deeply embedded and became a fundamental part of the simulation model, and not just an add-on. This is one of the reasons why we have been able to develop many product features that are unique to Aurel.

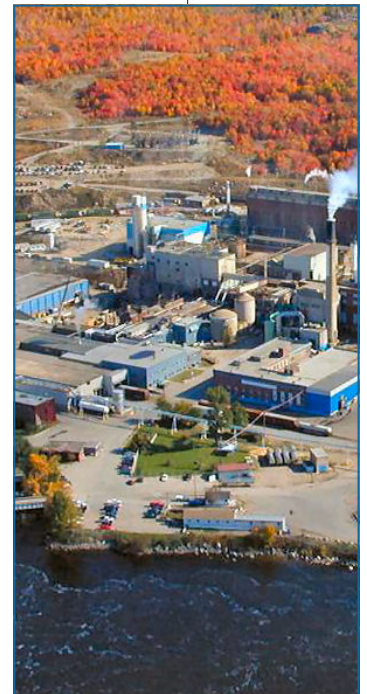***Where do you see Aurel heading in the next five years?***

In the next five years, Aurel will continue to develop CADSIM Plus solutions for a variety of industries. We plan to offer assistance for companies implementing on-line optimization, advanced control, operator training, product tracking and data reconciliation.

We will continue to develop tools that manage all aspects of process knowledge, indexed in the most understandable way possible – from a process draw-

ing. Just as 'a picture is worth a thousand words', a drawing can be worth a million words when it becomes a portal to a plant's information systems.

Aurel is focusing on the use of superior process models for optimization and control. Our Dynamic Data Reconciliation (DDR) is a foundation technology that will make many of these innovations possible.

I see a day, in the not-too-distant future, when personnel, plant-wide, will be able to click on a drawing of a process and get current operating parameters for every stream, even though they are not measured; be able to access context-sensitive training and operation reference manuals; get DCS trend information; find the reasons for the selection of a particular piece of equipment in a database – all indexed from an electronic process flowsheet.

You have said that your unique Dynamic Data Reconciliation is a foundation technology for what comes next. Could you explain?

We are seeking a better way of doing on-line optimization. Every optimization or control application is based on a process model. In the past, the complexity of models used for these applications had to be kept low. A simulation-based model has the potential of being much more accurate.

But there is a problem. The simulation has to be able to start from current operating conditions. Traditionally, it would take a good engineer weeks to get a simulation to match a steady-state process operation, and much longer than that to add process dynamics. But that kind of timeline would be useless for on-line optimization and control.

This is where Dynamic Data Reconciliation fits in. One computer can be dedicated to tracking the dynamics of a process in real time. Another computer, with the same simulation model, can 'clone' an instance of the complete dynamic profile of the current plant operation. With DDR we can now initialize another dynamic model of the process and then run this second model faster than real time, to perform optimization and control functions.

DDR is the key. It makes it possible to fill in missing data and reconcile inaccurate measurements, resulting in reliable and complete data that is fit to a first-principles simulation model. It provides accurate process information that is the basis of better process decisions. It could initialize process models used for on-line optimization.

There are a couple of new DDR on-line applications currently running at Tembec's Specialty Cellulose Division in Temiscaming (*pictured on Page 1*).

What are "Living Drawings" and what part do they play in your on-line application strategy?

Living Drawings are Aurel's concept of turning paper-based P&ID drawings into electronic flowsheets that can act as a portal to obtain information about a live process. Anyone can follow a process drawing and locate an area of interest. Add the ability to drill down to obtain more information, and you've got a huge benefit.

Currently, plant drawings are done many times over. We do study drawings, P&IDs, DCS checkout, Operator Training Simulation (OTS), reference and training illustrations, and process improvement studies. Each phase requires a set of drawings that are created and recreated for a specific purpose, and then often abandoned because they quickly go out of date. And the whole process is prone to error.

A simulation flowsheet vets a drawing because the resulting model needs to be accurate in order to simulate the process. The checks and balances of process modeling ensure that the associated drawings are correct and kept up to date because with CADSIM Plus, the drawing *is* the simulation.

A CADSIM Plus simulation drawing with DDR can span the process lifetime, from conception to grave. It can provide current data for every part of the process, even where none is measured. It could produce trend charts on demand. It could be a portal to databases of stored process knowledge. It could be integrated with out Computer Based Manual (CBM) technology to provide advanced process reference materials. It could become an important part of an intelligent knowledge management system.

I am very excited about the potential of these technologies. This is a concept that I've had in the back of my mind for more than 20 years and we are really close to seeing that vision fulfilled.

When not busy with Aurel, Larry can be found "relaxing" on his bicycle, where he considers 100kms ridden to be "a good warm-up." Shown here, 22 hours into the Paris-Brest-Paris 1200 km marathon.

Tech Corner: Creating a CADSIM Plus Computer-Based Manual

CADSIM Plus v2.5 (Standard and Trainer versions) includes a new feature that makes it possible to link HTML documentation to your CADSIM Plus simulation. This allows you to create a computer-based manual (CBM) that relates training and other types of content to technical drawings and simulation models. CADSIM Plus electronic P&ID drawings are ideally suited to this application.

The CBM feature is just one of a number of technologies that Aurel has been working on over the past few years, with the ultimate objective of making the CADSIM Plus drawing/model a portal to other information about the plant, the process and its operation.

You can embed links within a CADSIM Plus drawing that connect to an HTML document, and visa versa. When the user clicks on a piece of equipment that has a link, the linked page will open in a second HTML viewer window. Similarly, when the user clicks on a link on the HTML page, the associated item in the drawing will be viewed and highlighted. Other functions can also be performed by these embedded links, such as launching another application or controlling the simulation.

Here are the basic steps involved in creating a CADSIM Plus computer-based manual:

1. Develop and test a CADSIM Plus simulation drawing/model. The drawing may be a full P&ID drawing which accurately represents equipment, streams, controls and interlocks, or it may be a simple schematic drawing.

2. Develop the documentation that will accompany the drawing/model. This may be some form of static training or reference material for the process.

3. Use the Add Group and Manage Group tools in CADSIM Plus to group and name drawing objects that relate to the training materials. These groups can be given CADSIM Plus HTML commands that are executed when they are clicked on by the user in simulation + training mode.

4. Create HTML pages and add the content that was developed in Step 2. Almost any HTML authoring tool or text editor can be used to develop HTML pages and to add CADSIM Plus HTML commands. Depending on the authoring tool used, some knowledge of web page development may be required for this step.

5. Add CADSIM Plus HTML commands to text links, buttons or embedded JavaScript in the HTML pages to control how the drawing/model is displayed or run. The purpose of this step is to link the HTML documentation to specific areas of the drawing/model, and visa versa, thereby using the drawing as a visual aid to support the documentation.

6. Add start-up options to the CADSIM Plus model/drawing, or to the HTML pages, to load specific drawings or pages. You will have to decide whether the HTML pages are going to launch CADSIM Plus (via the external CBMViewer that is distributed with CADSIM Plus), or whether CADSIM Plus is going to open HTML pages (via its internal viewer).

7. Test each interaction as you develop your HTML content.

8. Distribute your drawing/model along with the associated HTML pages. The user can also run the simulation model in order to display process results on the drawing while viewing the training/reference manual.

CADSIM Plus v2.5 ships with an example CBM project that is located in My CADSIM\Samples\CBM.

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CADSIM PLUS

Did you know...?

To make a heat exchanger predictive, create a simulation with a standard exchanger, setting flows and one outlet temperature to match an existing operation. Run the model to steady state and take note of the heat transfer coefficient. Now add the 'SET_U' keyword to the heat exchanger's polygon text and then provide the heat transfer coefficient noted above. This will allow the heat exchanger to predict both outlet temperatures.

New features in CADSIM Plus v2.5

Standard CADSIM Plus package now includes
- Dynamic Data Reconciliation library
- OPC library   *(OPC & DDR were optional at extra charge)*

Automated Controller Tuning Wizard (Autotune)
- Performs bump tests, and process response analysis
- Automatic process model identification (self regulating/ integrating, direct/indirect)
- Automatic setting of Lambda tuning parameters (user can fine-tune and test proposed settings)
- Response quickness and stability are tested on simulation before committing
- Simulation is automatically restored to the state that existed prior to the auto tuning session to avoid simulation upset

Computer Based Manuals for Training & Reference
- HTML pages can be integrated with 'intelligent' CADSIM Plus P&ID drawings to produce electronic training materials

New & Improved Unit Modules
- Flash unit (optional holdup and level control added) *Improved!*
- Uptime unit (now with Weibull distributions) *Improved!*
- Pass-Through unit (adds the ability to suspend a unit from participating in the simulation model) *New!*
- Heat Exchangers *Improved!*
- Heaters / Coolers *Improved!*
- Dynamic Data Reconciliation (allows pre-conditioning and filtering of individual measurements using Kalman) *Improved!*
- Pipe unit (proportioning of viscosities of mixtures) *Improved!*
- Compressor unit (now works within pressure flow networks, includes performance curves) *Improved!*
- New Excel spreadsheets help set up pump and compressor curves, and valve characteristics

Streams & Chemistry
- Improved stream flashing & vapor/liquid equilibria calculations
- Improved water/ice, liquid/solid equilibria with freezing point depression

Physical Properties
- Improved saturation temperatures, enthalpys and entropies
- New minerals

Graphical User Interface Improvements
- *Find Furthest Off* function now monitors steady-state convergence status in toolbar
- New chart cleanup/align tool right-justifies and sorts open charts on your screen

On-line Applications
- New *Startup Dynamic Profile* (process snapshot file) stores and retrieves startup values that include unit dynamic profiles
- CADSIM Plus drawing can launch an external application
- Support for cloning a simulation from an existing on-line tracking reconciliation simulation to display current data for the full process with stream details. Can be used to: run into the future; form the basis for on-line optimization trials; form the basis for 'what-if' scenarios starting from current operating parameters