CADSIMulator

CADSIM Plus Process Simulation News

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Tembec Signs Corporate-Wide CADSIM Plus Lease

On May 27, Aurel Systems announced that it had signed a corporate-wide lease agreement with Tembec Inc. to place its CADSIM Plus dynamic process simulation software in all 14 of Tembec's pulp and paper mills, as well as in Tembec's corporate offices in Temiscaming, QC.

Tembec is a leading integrated Canadian forest products company. With annual sales over $3 billion dollars, Tembec operates more than 50 manufacturing units in Canada, France, and the United States, and employs approximately 10,000 people.

"We chose CADSIM Plus because it offers the best value for our money," said Marc Champagne, Process Optimization Manager for Tembec. "CADSIM Plus has a superior combination of features, modeling flexibility, and ease-of-use as compared to the other process simulation software for pulp and paper that we've seen."

When asked about applications for process simulation at Tembec, Mr. Champagne replied, "Before a major retrofit proposal will be approved, senior management is asking that a simulation is done to show that the changes can work. People are not authorizing projects unless process changes and conditions have been identified, tested, and proven."

"I have used CADSIM Plus quite extensively for different projects in several mills," said Mohamad Masudy, Process Optimization Specialist for Tembec. "I believe that the strength of utilizing CADSIM Plus is that dynamic modeling can be done quite easily, without the need of getting into the mathematics behind first principal models. Dynamic simulation is often required due to the dynamic nature of most problems in the industry."

Projects in which CADSIM Plus has been used at Tembec mills include:

- Steam plant studies, using connections to the mill's PI data system
- Board mill water reduction studies
- A Kraft mill study
- New mill process design
- Process balance with some training capabilities
- Boiler feedwater heating and energy studies
- Paprican bleach and mill study balances

> *"We chose CADSIM Plus because it offers the best value for our money."*

"Our successful field evaluations of CADSIM Plus have satisfied us that Aurel's software and services are a valuable asset that will assist us in meeting our objectives of continuous improvement of processes and product quality and energy efficiency, while honouring our commitment to environmental responsibility," said Mr. Champagne.

"We look forward to partnering with Aurel Systems in the development of new applications, in which CADSIM Plus will be linked to our mill control and information systems, to provide control and operational enhancements," added Mr. Champagne.

"Tembec has the reputation of being a progressive company that uses new technologies to great advantage," said Larry Wasik, President of Aurel Systems Inc. "We are very excited about partnering with Tembec in the continued development of state of the art tools for engineering design, problem evaluation, case study, and operator training and assistance.

Inside this issue:

Welcome to the premier issue of *CADSIMulator*, Aurel Systems' CADSIM Plus process simulation newsletter.

This newsletter will cover topics of interest for process engineers who use, or are considering the use of process simulation in their work.

We hope that you enjoy the first issue!

Next Issue:

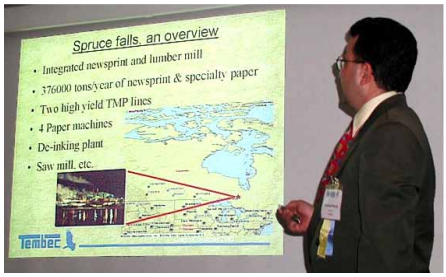
· Calculating pulp slurry friction losses

· Focus on consultant's use of CADSIM Plus

Dynamic Simulation Used to Evaluate Steam Strategies at Spruce Falls

by Mohamad Masudy

At Tembec's Spruce Falls mill at Kapuskasing, a study was undertaken using CADSIM Plus to create a dynamic simulation of the mill's steam generation



Mohamad Masudy presents his CADSIM Plus study of Spruce Falls at Control Systems 2002 in Sweden

and distribution systems, in order to evaluate alternative solutions to the large steam demand swings that resulted when a loss of TMP heat recovery occurred. The objectives of the study were to reduce stand-by boiler energy costs and boiler control problems.

The Spruce Falls mill utilizes three biomass boilers for its primary steam production. This is supplemented by low pressure steam that is reclaimed from the thermo-mechanical pulping (TMP) system, and by three stand-by water-tube gas boilers.

Occasionally, double feed-guards cause sudden loss of TMP steam supply, resulting in a loss of drum pressure in the stand-by boilers. A lag time of 15 minutes is required to safely ramp the stand-by boilers up to demand in order to avoid boiler priming, which can result in a further loss of steam production.

A dynamic model of the six boilers was constructed using CADSIM Plus. The controllers for each boiler were tuned so that the model matched each boiler. Boiler priming effects and corresponding evasive control actions were also modeled.

For modeling purposes, steam demand was based on historical mill data. Many transient uses of steam in the mill were added to the model, along with random downtime events based on mill equipment availability statistics. Seasonal operating conditions were also modeled.

A variety of economic and time-based factors were considered in the evaluation of nine alternatives, ranging from improved control strategies, to new equipment such as a steam accumulator, an electric boiler, a low pressure (LP) header vent silencer, and changing a steam driven fan pump to electric drive.

Based on the observations and a cost analysis, a combination of a new steam accumulator and an LP header silencer rose to the top of the list. CADSIM Plus was then used to verify the findings, and final results were presented to the mill management and used as project justification. CADSIM Plus was then used to size the new steam accumulator.

Tembec engineers found that the CADSIM Plus dynamic simulator is a powerful tool for evaluating process design, modifications, and optimization. Complemented with financial data, it can be used to assess project feasibility in capital-intensive projects. The same models can then be used throughout the project lifecycle to optimize the process.

Energy Reduction Study at Harmac Pulp Operations

by John Coulson

In the Spring of 1999, Harmac Pulp Operations of Pope & Talbot Inc. decommissioned two hog-fired boilers, without increasing the remaining power boiler's fossil fuel consumption.

A target steam reduction of 60,000 lbs/hr, which represented 5.5% of the mill's total steam consumption, was identified as the minimum necessary to permit taking the boilers out of service.

The first task was to improve the tracking and reporting of the mill's steam and energy consumption. The reporting system was modernized, flow diagrams were updated, flow meters were identified and calibrated, and new meters were installed as required.

Once measurement system accuracy was assured, the mill's SQL database was expanded to include 200 points of additional steam and energy data. The resulting data was then linked to Excel spreadsheets for reporting.

The next task was to identify steam reduction opportunities. Tramp water incursion into the weak black liquor system was recognized as a potential source of energy savings.

Dynamic CADSIM Plus models were developed for the mill's process areas, including the evaporator/ concentrator plant, blow heat recovery system, bleach plants, recaust, and cleaners/pulp machines. In addition, an overall mill energy balance was constructed. Consequently, it was estimated that the weak black liquor solids from the Kraft mill could be increased from 17.0% to 18.5% through a series of simple modifications. Sources of tramp water entering the weak black system were eliminated through repiping.

Ultimately, weak black liquor solids were increased to 18.3%, very close to the CADSIM Plus model predictions. Steam savings of 40,000 lbs/hr were verified, and were within 2% of the model predictions. The estimated total cost of this project was $150,000. Estimated annual natural gas savings of $2.6 million were realized, for an ROI that exceeds 1700%. Summer water consumption was also reduced by 4,000 USGPM.

In subsequent projects using Pinch Analysis on Harmac's heat recovery and hot and warm water systems, dynamic

CADSIM Plus models were used to verify the proposed modifications. Heat exchanger and other modifications resulted in steam savings that were very close to the model predictions, amounting to a combined total savings of approximately 49,800 lbs/hr.

When these projects had been completed, Harmac engineers had successfully reduced total mill steam consumption by almost 10%, allowing the decommissioning of the hog-fired boilers, while achieving total annual energy saving of roughly $6.0 million per year.

Tech Corner: Linking CADSIM Plus to Mill Data

You can use Microsoft Excel to download data from your mill's data logger and then link it to your CADSIM Plus simulation.

Assume you have a list of values from your data logger, which consists of volumetric flow, temperature, and time (*see Figure 1*). Start by creating a simulation Input/Output (I/O) area on an Excel worksheet. Create the headings 'time', 'flow', and 'temperature', where time will be an input from CADSIM Plus and flow and temperature will be output to CADSIM Plus.

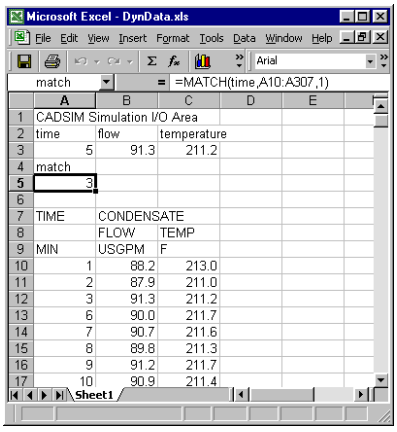


Figure 1: Excel

Click the cell immediately below each of these headings, and select Insert > Name > Define. Excel will automatically pick up the heading of the cell above. Click OK to accept the name of the cell. Now cell A3 will be named *time*, and no matter where you move the cell later, CADSIM Plus will maintain its link by that name. Also, create a heading and cell named 'match' which will be described later.

CADSIM Plus will send a time value to Excel, and Excel will then return the appropriate values for flow and temperature that correspond to that time value. Use Excel's INDEX function to do this. For example, placing INDEX(B10:B307,time) in the cell named *flow* (B3) will make a range of flow values available to that cell – in this case our sample mill data for flow starts at B10 and ends at B307. A similar index is used to get temperature values for the cell named *temperature* (C3) in column C.

If all of the time increments were equal, CADSIM Plus could auto-increment to obtain the values it needed from the table without requiring this indexed look up method. But how do we accommodate time with non-uniform time steps? In *Figure 1*, note that the rows for time 4 and 5 have been removed – possibly due to bad data. Excel has a MATCH function that makes this task easy.

Use the formula MATCH(time, A10:A307,1) in cell *match* (A5). This will look down the time column and return the appropriate data row. However, note that the MATCH function for time 3, 4, or 5 returns the same row of data (data for time 3).

Now we can use the cell value of *match* instead of *time* in our INDEX functions. Place INDEX(B10:B307,match) in the cell named *flow* (B3) and INDEX(C10:C307,match) in the cell named *temperature* (C3). The worksheet is now ready for communication with CADSIM Plus.

Create a CADSIM Plus DDE Client communication link to the Excel worksheet (*see Figure 2*) by following the directions in the online module help files (under *DDEClient*). Note the identification of the specific worksheet and the list of variable names in pairs, first the CADSIM Plus variable name shown in uppercase, followed by the cell's name in parenthesis (*see Figure 2*).

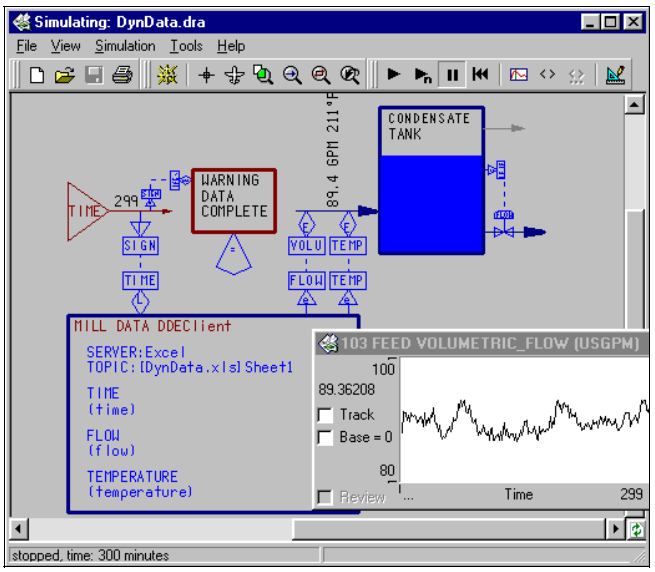


Figure 2: CADSIM Plus

A CADSIM Plus TIME module has been added to the model to provide the simulation time to Excel in minutes. Caution: a time value of zero will result in "#N/A" in each of the *match*, *flow*, and *temperature* cells, and result in invalid data being returned to CADSIM Plus. To avoid this, use a Linear specification to add 1.0 to the time so that it can never be less than 1.0.

The returned values for flow and temperature are shown linked to values for a process stream using CADSIM Plus Equate specifications.

Since you do not want to exceed the amount of data that you have collected in Excel, as a final touch you can include a CADSIM Plus WARNING module that will pop up when simulated time has reached the end of the data in Excel.

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CADSIMPLUS

A Brief History of Aurel Systems

In 1983, Larry Wasik, president of Aurel Systems Inc. was a member of a small group of process engineers who pioneered the use of process simulation at a large engineering consulting company. Mr. Wasik soon realized that the simulation software of the day was too difficult to learn and use by typical process engineers. He began working on a smart Computer Assisted Drawing (CAD) interface that would build the required data for a process model.

In 1986, Aurel released CADSIM® which was a dedicated interface to a popular steady state process simulator that was used in the pulp and paper industries. CADSIM allowed a CAD drawing to be the source of simulation data, and to display simulation results on the same drawing.

In 1989, work began on transforming the CADSIM drawing interface into a complete dynamic process simulation package that would include a modular stream-based architecture, a sequential solver, and an interactive runtime interface. Design emphasis was placed on easy graphical modeling, fast performance, flexible process specification, and open-systems expandability. CADSIM Plus was commercially released in 1995. CADSIM software products are used in 22 countries.

New Features in CADSIM Plus v2.2

Aurel is pleased to announce the release of version 2.2 of CADSIM Plus. The entire runtime interface has been revamped, with new dialog boxes and online help. Some of the new features include:

- Multi-threading permits you to manipulate controller setpoints or specification values while the simulation continues to run—more like the real process.
- Have one of each type of controller and stream or unit dialog boxes open simultaneously.
- Charts can now plot and track multiple variables in one chart window. Charts can also be resized.
- Additional methods of editing multiple specifications allow you to make changes without having to remove and recreate them.
- New multi-lingual support for CADSIM Plus menus, dialogue boxes, and displays. Switch languages on the fly. Design in one language and display your drawing in another language.
- Arrowhead fills offer better appearance on screen and plotting.
- New run *n* iterations feature.
- Over 200 new P&C drawing parts join the extensive P&ID library of drawing parts.
- DDE item auto-increment.
- New Saveall and Thickener modules.

Please contact Aurel for upgrade information.

Did you know...

Rather than setting a steam temperature which can change with pressure, you can use a linear specification to set the temperature to the Saturation Temperature, or Saturation Temperature plus x degrees of superheat. Liquid streams can also be equated to the Boiling Temperature.