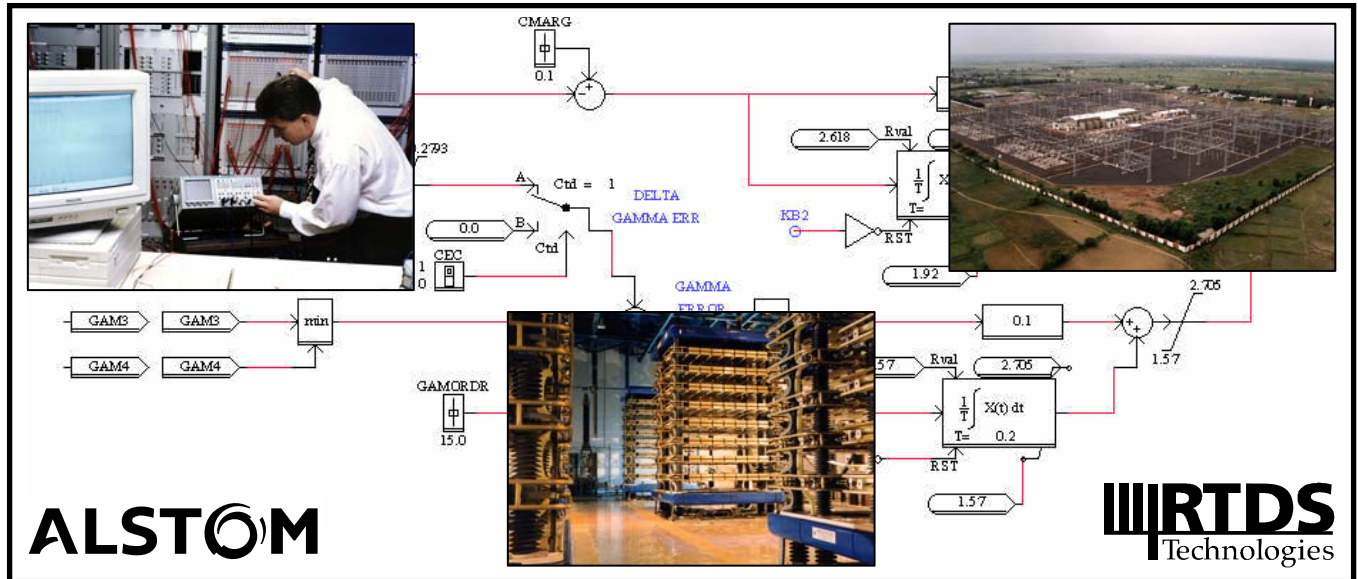


RTDS NEWS

December 2000

Real time digital simulation for the power industry



ALSTOM T&D Power Electronics – Innovative Use of Control System Simulations

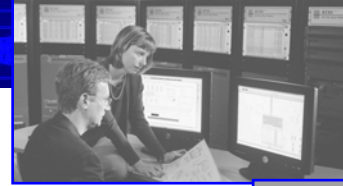
ALSTOM T&D Power Electronic Systems (Stafford, UK) has used the RTDS Simulator for HVDC and SVC control system testing since 1994. The largest study performed to date was a co-ordination study between two HVDC schemes installed in close proximity, namely the Chandrapur back-to-back and the Chandrapur-Padghe transmission system.

For most testing, the physical controls are connected to the RTDS Simulator. Here the simulator represents the power system to which the controls will later be connected. However, ALSTOM has expanded its use of the Simulator to sometimes include simulation of the control system as well.

The RTDS control system software first proved useful to ALSTOM as a tool for conceptual design of the slower control functions. An example of such controls are those for reactive power and ac voltage control, including tap changer action and shunt element switching.

This technique was applied for Rivera, ALSTOM's latest back-to-back, between Uruguay and Brazil. Protection functions were also modeled in the Simulator to test whether the protection would operate in some extreme cases.

Recently, the functions of ALSTOM HVDC control equipment which determine fast dynamics were also implemented in the RTDS Simulator and validated against manufactured controls. This included; the phase-locked oscillator with phase limits and frequency correction, various inner control loops (I_{DC} , V_{DC} , AC overvoltage, α and γ limit control), control loop selection, voltage dependent current order limits (VDCOL), α and γ balancing, and power trim control. To observe the true response of these precise controls, the Improved Firing Algorithm (IFA) was used to overcome the jitter effect that results when firing pulses arrive asynchronously during a timestep.



Upcoming Events

IEEE/PES Winter Meeting

Exhibition January 30-31, 2001 in Columbus, USA

DPSP 2001

Exhibition April 9-12, 2001 in Amsterdam, Netherlands

IPST 2001

Presenting at Conference June 24-28, 2001 in Rio, Brazil

IEEE/PES Summer Meeting

Hospitality Suite July 24-28, 2001 in Vancouver, Canada

Since the number of control blocks that can be placed on one processor is limited for real time operation, it is often necessary to use several processors to model a complete controller. Where necessary it is possible to check for any adverse effects arising from time step delays between fast control units modeled in different processors by verifying the operation on the RTDS in non-real time mode. In non-real time mode, smaller timesteps (10 μ s typically was used) can be achieved. Time savings are gained by using the RTDS's parallel processing capability for very fast non-real time calculations rather than other PC or workstation based software.

Detailed simulation of the control system using the RTDS Simulator allows Alstom an efficient means to develop prototype controls without the need to have the actual control hardware available. With the controls implemented on the Simulator, they are readily connected to the simulated power system and their performance can be judged under realistic conditions.

Thanks to ALSTOM T&D Power Electronic Systems (Stafford, UK) for their contribution to the article.

V3 Machine Model

A new machine model has been developed that includes the unit transformer as part of the model. The new model requires only one 3PC processor to compute the machine equations, the unit transformer, and the intermediate machine terminal nodes.

Having the model compute the intermediate nodes is a great advantage since these nodes do not have to be calculated by the network

solution. Thus, more nodes can be added to the rest of the power system without requiring additional hardware.

The V3 machine model is based on a new set of equations using flux linkages as state variables. Details of the model are described in a paper that will be presented at the IPST conference in Rio, Brazil in June 2001. Or, please contact RTDS Technologies for more information.

Upcoming PSCAD Release

In keeping with our maintenance program, we will be providing a new PSCAD release during the first quarter of 2001. Some of the features that can be expected in the release are:

- RunTime meters that change color when the measured value is outside the upper or lower limits
- Line to line quantity display from RunTime meters using optional sqrt(3) multiplier
- X-Y Plot component for RunTime
- Color printing from RunTime plots
- New 3PC Components; V3 Machine, Frequency Dependent T-Line, Dynamic Load, Generic Machine Controls, PT, and Numerous Controls Components

KEPS Simulator Shipped!

The world's largest and most advanced power system simulator, the KEPS RTDS Simulator, has now been shipped to Korea for installation at the KEPCO Research Institute. The Simulator passed the acceptance tests and will be commissioned in Korea during January 2001!

One of the acceptance tests for the system was to simulate the Largest Equivalent System (LES) for the KEPCO network. The LES was made up of 160 buses, 41 generators, 131 transmission lines, 78 transformers, and 60 dynamic loads. The system was successfully simulated in continuous real time using a 50 microsecond timestep.

Look for a feature article about the KEPS system in our next RTDS News!