B&W/MMS User Group Newsletter

MMS: A COMPUTER PROGRAM DEVELOPED BY THE ELECTRIC POWER RESEARCH INSTITUTE

December 1985 Vol. 1 No. 3

The President's Corner

Our User Group meeting in San Francisco was a success. Ten of the twelve member organizations were represented. I would like to thank Bechtel-San Francisco for hosting this meeting. The meeting was a success for several reasons. We users were able to hear of the progress and problems of the other users. We learned first hand of the latest developments in MMS and MMS-Ease, and we provided input to the further development of these. The users' reports covered quite a variety of applications on both fossil and nuclear systems. The new User Group Bulletin Board was demonstrated, and I urge each of you to take full advantage of it as an electronic newsletter/communications medium.

Your Advisory Committee has given its approval for a new class of educational membership. We hope that this new class of membership will allow universities to join and participate. Also, the Advisory Committee took a position supportive of B&W's effort to bring additional foreign organizations into the User Group membership.

Speaking of membership, I would like to welcome as new B&W User Group members

- Public Service Electric and Gas
- San Diego Gas and Electric

The second MMS-B&W Training Session was conducted October 14-18, 1985 at B&W's Nuclear Power Division in Lynchburg, Virginia. Seven engineers representing Duke Power, TVA, and Detroit Edison attended. The course material was very well received, and everyone felt the class size was just right. Of the items covered, the debug session and the MMS-EASE+ session were of the most interest. The next training session will be held in Lynchburg in April 1986.

Plans are being made to hold the next meeting of the Users' Group in conjunction with the Eastern Computer Simulation Conference. This conference will be in Norfolk, Virginia, March 10th through March 12th. As plans now stand, the Users' Group would meet on the afternoon of March 12th and all day March 13th. I will keep you informed as plans develop over the next couple of months, but for now mark your calendars.

Charles Sayles
President

November 19, 1985

Verification of Heater Drain System Model a Success

A second series of plant testing has verified the accuracy and flexibility of a thirteen state feedwater heater drain system model for Duke Power's Oconee Nuclear Station. System modeler, Norman Stambaugh, is enthusiastic about the results, and says, "It appears that, given sufficient details concerning the valves and controls associated with a system, and the appropriate initial conditions of both the mechanical and control systems, MMS is capable of very accurately modeling plant systems. This ability permits the modeler to make very specific, practical recommendations concerning design changes to correct problems in the plant."

The first test at Oconee was done with control system settings which were as-designed. The normal heater level was controlled at 7 inches, and the high level dump valve began to open at 10.5 inches. A pump-trip transient was used in the test. The system response in this case was very unstable due to the lag time of the dump valve. The model response for this first test agreed very well with the plant test data, and the responses are compared in Figure 1.

The second test was an attempt to verify the predicted, corrected response of the model after making the recommended changes in the plant. It was assumed that the control system settings would be the same as in the first test. However, during the first run of the second test, intended to duplicate the unstable response of the first test, it was discovered that the initial control system settings had changed, such that now the normal level was controlling at 8.12 inches, with the high level dump valve set to open at 7.94 inches. This resulted in the dump valve being 5% open during normal pump-ahead operation of the heater drain system, resulting in a significant heat loss for the unit. When the initial conditions of the model were changed to reflect these control settings, again, the responses matched up very well, as shown in Figure 2. The plant response was more stable than during the first test due to the reduced lag time of the dump valve, resulting from it starting from a 5% open position. However, the loss of heat from the valve being 5% open was very undesirable.

For the second run of the second test, the changes recommended following the first test were made to the system in the plant, and the pump was tripped again. As expected, the response of the system was made even more stable. The initial conditions of the first and second runs were the same; the only difference was the recommended changes. Using the same model configuration as in the first run, and using the original model parameter changes calculated following the first test (reflecting the recommended changes made in the plant), the model was run again. The model response this time accurately predicted the response seen in the plant! These responses are shown in Figure 3.

Although the response shown in Figure 3 is a very stable one, it comes at the sacrifice of dumping useful heat to the condenser through the 5% open dump valve. Changing the control settings in the model to reflect the original settings (as in the first test, to keep the valve closed), and keeping the recommended changes in the model, the model was run again. This model

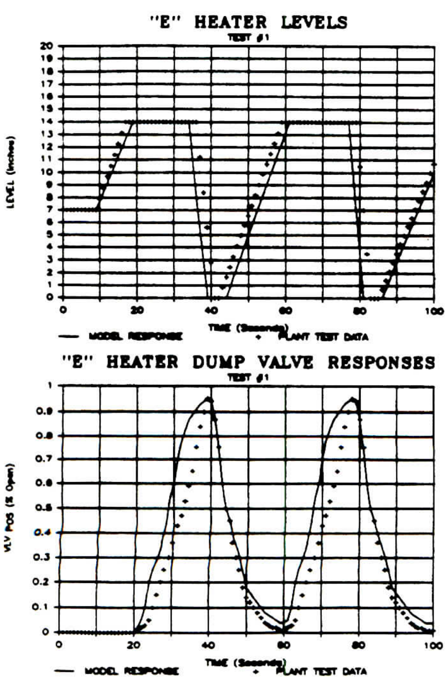

FIGURE 1

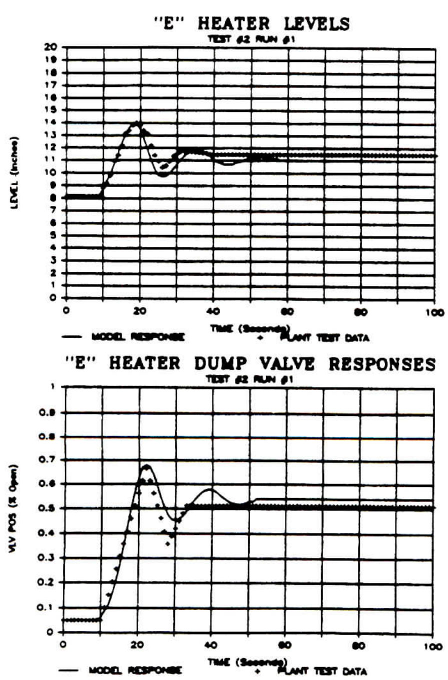

FIGURE 2

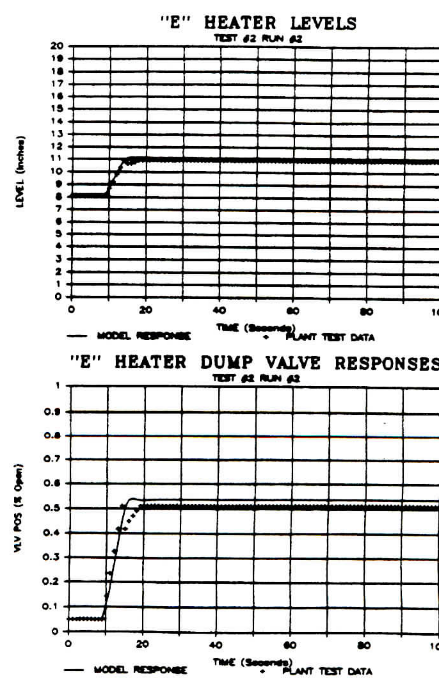

FIGURE 3

response is shown in Figure 4, and is the one being recommended for Oconee.

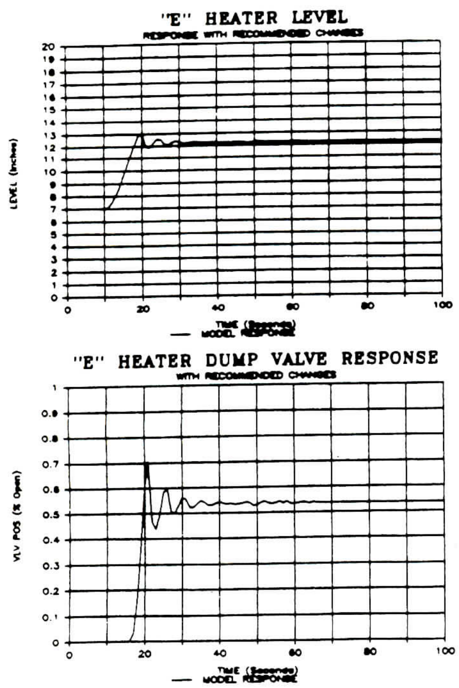

FIGURE 4

Among the problems this model will help solve for Duke Power's Oconee Nuclear Station are:

- Pump motor burn-up resulting from trying to start the pumps while the level is oscillating over the full range.
- Numerous power holds at 95% power due to delays in starting the pumps.
- Unnecessary wear on the pumps and pump motors, especially relative to the pump motor duty cycles.
- The inability to place the pumps in service at 40% power due to insufficient flow through the heaters to "cushion" the oscillations and fill the heaters back up upon starting the pumps.
- Increased probability of unit trips due to the need for "E" heater drain flows for the CBP's, above 95% power.
- Inefficient use of operations personnel by tying them up on trying to get the pumps started.

Duke Power plans to use a similar approach to problem solving by modeling portions of Oconee's lower condensate and feedwater recirculation systems. All of the information used in their heater drain system model was available as design information, with no changes to the MMS parameters required to get plant and model responses to match up. Duke feels that verification is a necessary step in the modeling process, primarily because it is the best way to learn proper modeling techniques and reveal unsuspected contributors to plant system responses. With the careful application of design information and modeling techniques, the need for future verification testing can be greatly reduced.

NORM STAMBAUGH
DUKE POWER CO.

Colorado-Ute Circulating Fluidized Bed BOP Model Developed

In May of 1985, the Philadelphia Electric Co. was contracted by EPRI to model the balance-of-plant for the Colorado-Ute Electric Association's Nucla Circulating Fluidized Bed (CFB) Demonstration Plant. This life extension project is employing a new CFB, designed by the Pyropower Co., and is rated to produce 925,000 lb/hr of steam at a pressure of 1465 psia, and a temperature of 1000 degrees F. Scheduled for completion in 1987, the balance-of-plant consists of a new 74 MW Westinghouse auto extraction turbine and its associated feedwater system. In addition, there exists three old 12 MW turbines, each with their own individual feedwater heaters, deaerators and condensers. The old systems join the new system at a new deaerator and then proceed through two high pressure feedwater heaters. In all, the balance-of-plant contains 10 feedwater heaters, four deaerators, four condensers, 16 pumps, four turbines, and numerous valves.

For the sake of modeling, the plant was broken up into four units, (one new and three old), with each unit divided into 3 subsystems. Since the three old units are identical, in order to save computational costs and cut down on the number of variables generated, only two are being modeled explicitly. The third will be equated to one of the modeled subsystems in order to account for variations in operating procedures. When all the subsystems are integrated into an entire balance-of-plant model there will be approximately 150 states.

At the time of this writing, all of the subsystems have been successfully modeled. Null transients have been run on all of them and in most cases a steady state has been achieved after 300 seconds of simulation time. Some of the subsystems have had process disturbances imposed on them and the transient data analyzed for quantitative reasonability. From the results, it appears that the MMS code is performing well. The subsystems are now being incorporated into a total plant model so that future control system studies can be performed on the model.

In the coming months, an ACSL fluidized bed boiler model created by a third party will be integrated into the balance-of-plant model. The entire system will then undergo such transients as boiler trip, turbine trip, and loss of control power to identify any possible operating problems the plant might experience.

DAVE DIMENSTEIN
PHILADELPHIA ELECTRIC CO.

Remote Bulletin Board in Operation

A Remote Bulletin Board System (RBBS) has been established for use by the User Group. This system will allow User Group members to disseminate and/or receive information, distribute messages and up- or download files. The system hardware configuration consists of an IBM XT with 640K and 2 360K floppies, Everex Graphics Edge and an IBM monochrome monitor.

Access to the system is similar to accessing a remote mainframe. You will need a terminal emulator program, a communications (COM) port on your computer, and a MODEM connected to your COM port and the telephone system. The telephone number to dial is 804/385-3493. The system is normally on-line from 1:00 P.M. until 8:00 A.M. the next morning, except weekends, when it is off-line all day. The system operates at 300 or 1200 baud, even or no parity, 8 data bits and one stopbit. The SYStem OPerator (SYSOP) is Ross D. Schaack (804/385-2584).

Once you have called in and established connections, you must press the return key once or twice to establish the communication parameters. You will then be asked to login. See the MMS UG RBBS User's Guide for more information.

So far, the User Group membership has suggested the following uses for the RBBS:

- A list of the computers, operating systems, and contact people for each of the members.
- A list of the people using MMS at each member's offices, and any special expertise they may have.
- A library of MMS models, available for downloading.

If you have any additional ideas, please login and leave the SYSOP a message. He'll be happy to work on your suggestion.

ROSS SCHAACK
BABCOCK & WILCOX

Controls Modules Completed

A set of MMS modules has been completed which will allow easier analysis of control systems. Ten modules have been developed, representing the following control system components:

- SUMMER
- MULTIPLIER
- AUCTIONEER
- FUNCTION GENERATOR
- LEVEL TRANSMITTER
- DELTA-P TRANSMITTER
- RATE LIMITED SIGNAL FOLLOWER
- DELAY RELAY
- SIGNAL MONITOR
- HAND/AUTO SWITCH

The modules were developed in a manner such that the field settings of the actual control system are the input numbers to the parameterizations (in most cases).

This set of modules uses a different method of connecting: it is a combination of the method that is used by the thermal-hydraulic modules and the method that is used by the previously existing control modules (ACT, ONOFF, PIDCNT). For the new control system modules, the control signal is ALWAYS passed from module to module via a variable whose first three letters are CSG, and that ends in the ID of the module in which it is defined. Connections are made by including the ID of the module you want to connect to in the parameter list of the macro call. That is, to connect a summer with an ID of SM1 to two other control system modules with ID's of CO1 and CO2, the macro call would appear as:

SUMMER("SM1", "CO1", "CO2")

The connection method is similar to the thermal-hydraulic modules in that the passed variable always starts with the same letters, and it is similar to the old control system modules in that a flow stream identifier is not used.

ROSS SCHAACK
BABCOCK & WILCOX

Merry Christmas

&

Happy New Year

Tom

Paul

Lance

MMS User Group Newsletter
Editors: Phil Bartells (804) 385-2637
Paul Henningson (804) 385-2209

Published quarterly by Babcock & Wilcox for the MMS User Group to report on current MMS developments and User Group activities.