

# B&W/MMS User Group Newsletter

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

January 1987

Vol.2 No.3

## DETROIT EDISON INVESTIGATES WATERHAMMER CAPABILITIES OF MMS

Detroit Edison has performed a partial evaluation of the pressure pulse or "waterhammer" capabilities of MMS -- a demand beyond its intent. Occasionally studies require the prediction of pressure pulsations, e.g., after sudden valve closure. To test the ability of MMS (and other codes in the past), MMS was used to model a nine segment, single phase water system shown in Figure 1 (reference Hydraulic Transients by V. L. Streeter). The response of the MMS model (with original modules) to a valve closure compared reasonably well with the theoretical and previous modeling results. However, with the extended range modules, MMS underpredicted the pressure peaks.

The nine segment fluid system was modeled as ten lumps in MMS and in the Edison in-house code (a lumped modular formulation with inertia and compressibility included). The transient is initiated by closing the valve at the outlet of the network from 100% open to 40% in 0.1 seconds. Except for the extended range MMS, numerical

limitations in the pipe modules prevented valve closure to the 40% point in one stroke. The pressure monitored was at the valve inlet.

Figure 2 shows the results from MMS with and without the inertia (INERT=0 or 1 flag). The dramatic effect of inertia is demonstrated by the 20 psi increase without inertia and 230 psi increase with inertia.

Figure 3 shows the comparison of the MMS (original modules), the Edison in-house model, and the text book "method of characteristics" results. All compare favorably with each other. Figure 4 shows the comparison between MMS with the original modules and extended range modules. The extended range modules show significantly damped pressure peaks.

(See DETROIT, page 2)

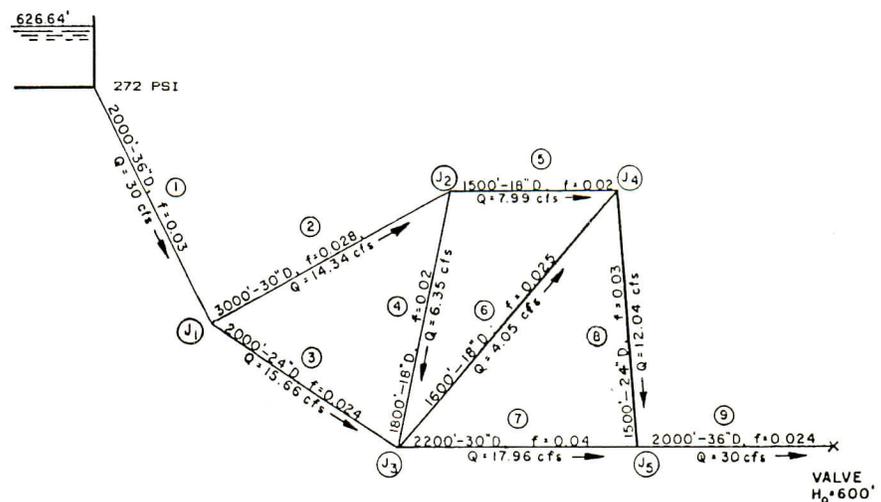


Figure 1. Physical Circuit Configuration, Reference Hydraulic Transients by V. L. Streeter

# TWO-PHASE OTSG MODULE BENCHMARKED

This is somewhat expected since the extended range modules are designed to more simply and reliably simulate low flow, reverse flow, and two phase conditions with some reduction in degree of detail. These results give us some feel for the ability and limitations of MMS and will help us more effectively use the code.

**CHUCK ARNDT  
DETROIT EDISON**

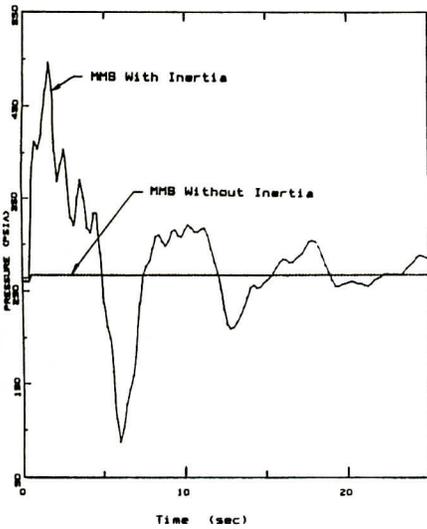


Figure 2. Comparison with and w/o inertia  
Original MMS single-phase modules

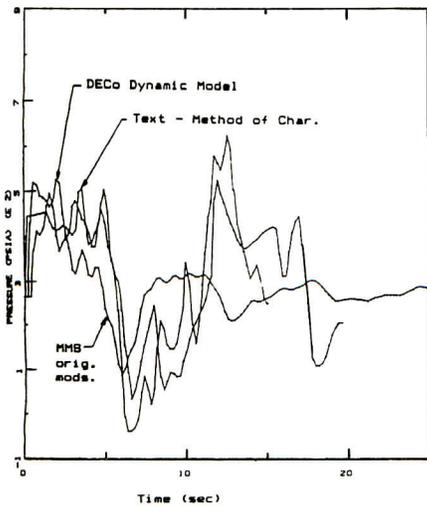


Figure 3. Comparison of Codes

In conjunction with one of B&W's model development projects, the MMS OTSGTP module was benchmarked against plant data. The data used for this benchmark was recorded during a Loss of offsite power transient that occurred at the Davis-Besse 1 nuclear power plant. The model that was used for the benchmark consisted of the OTSGTP module and a one-node steam line.

The model was developed and run on a Hewlett-Packard 9000 computer system. In the process of developing the model and running the benchmark, some modifications were made to the module and the MMS two-phase subroutines. These modifications include:

1. The flow calculation subroutine FFLOX had a discontinuous switch between the turbulent flow calculation and the laminar flow calculation. The calculation was corrected to provide a smoother switch.

2. The OTSG model assumed a constant average quality of 50% in the mixture region of the secondary side. A variable void-fraction model was added using a simplified drift-flux formulation.
3. The module would become unstable when the internal flow from the mixture region to the superheat region on the secondary side reversed. This was caused when the possibility of this flow reversing was ignored in the development of the modeling equations.
4. An explicit auxiliary feedwater (AFW) model was added to the module. Previously, AFW had to be injected through the main feedwater connection.

The plots on the next page show the results of the benchmark. In the plots, the curve marked with "A" is the plant data, and the curve marked with "B" is the MMS model. The first plot is the primary temperature leaving the steam generator (T-cold). The second plot is the steam generator level and the third plot is the steam generator pressure.

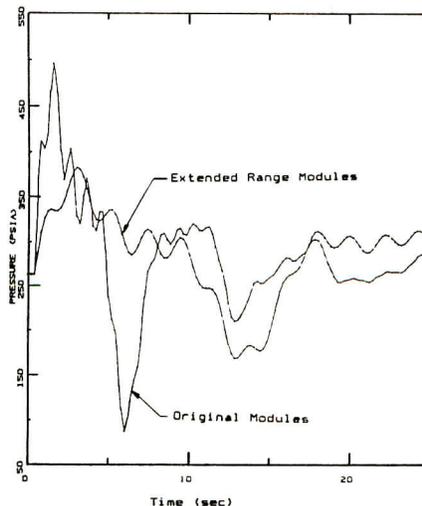


Figure 4. Effect of Extended Range Modules

This benchmark and the related work is very significant in that it has resulted in fairly major modifications to the MMS two-phase module library. The modifications will be released in June, anyone requiring the changes sooner should call the MMS hotline.

**ROSS SCHAACK**

# EDITORIAL

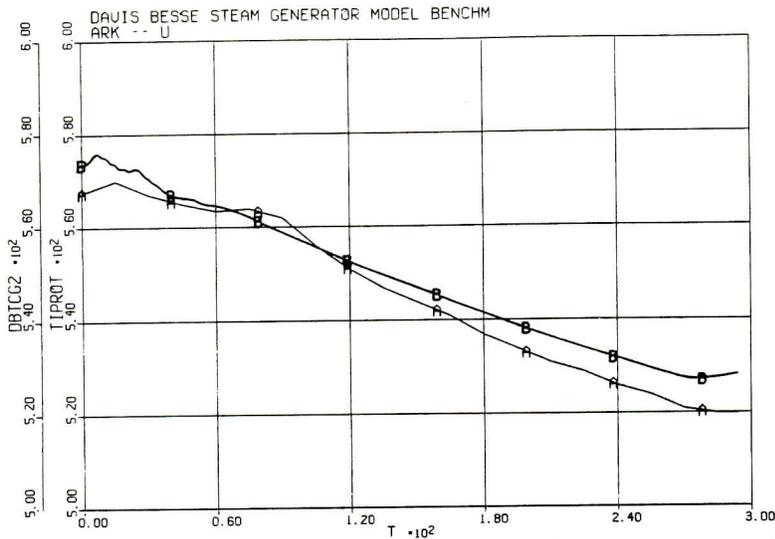


Figure 1. Temperature Leaving OTSG Primary Side

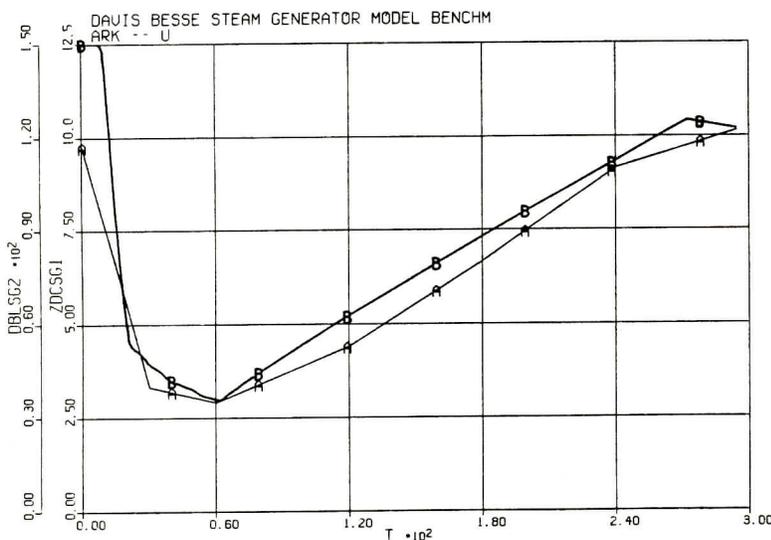


Figure 2. OTSG Secondary Side Level

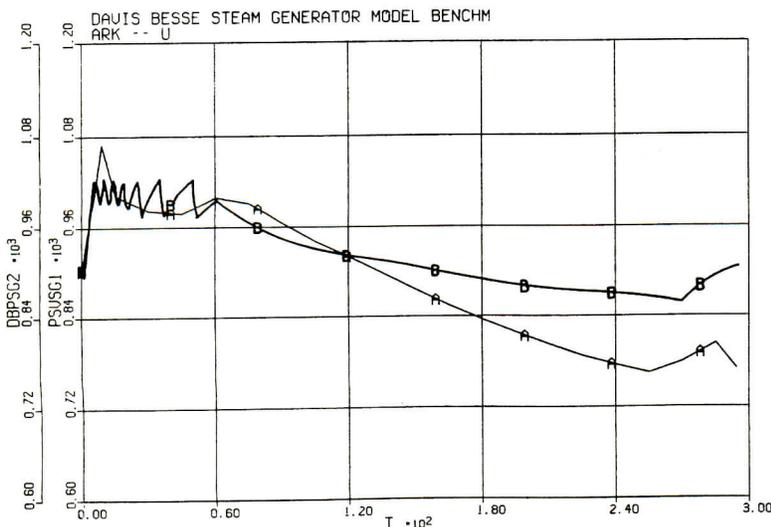


Figure 3. OTSG Secondary Side Pressure

It has been nearly two years since our original organizational meeting in March, 1984. Since then, MMS has come a long way and many changes, improvements and new features have been developed, many at the suggestion of the membership. I have thoroughly enjoyed helping to guide this work, and most of all have enjoyed meeting all those who have been associated with the MMS User Group. As we start our third year, I am looking forward to new and innovative uses for MMS and to development of new features.

It is virtually impossible to recognize all who have had a significant impact on MMS, but I do want to give special recognition to Lance Smith, Ron Dixon, Ross Schaack and Tom Wilson for their hard work in making the MMS what it is today. Working with them has made my job easy and a real pleasure. Of course, EPRI (especially Murthy Divakaruni and Frank Wong) has made very significant contributions.

The best part of the job is meeting all the users and potential users of MMS, and working with our marketing representatives. When I look back, because of the MMS I have traveled all over the US, to Mexico, Europe and to Japan twice. As someone once said, "it's a tough job, but someone has got to do it".

This issue is dated January instead of December and has no blue headers. Shifting the publication ahead one month will allow us to report on the User Group meetings in a more timely manner; not using color allows us to print it faster.

We need more articles from you, so get busy! This is your Newsletter and is your forum for technical exchange.

PHIL BARTELLS

# THE PRESIDENT'S CORNER

I would like to welcome a new member to our B&W/MMS User Group. The new member is Chiyoda Chemical Engineering and Construction Company of Yokohama, Japan. Chiyoda is the second member from Japan. They will be using MMS as a tool for fossil plant analysis and design.

Our most recent B&W/MMS User Group meeting went well. It was held last September in Knoxville, Tennessee and was hosted by TVA. Seventeen representatives from eleven member organizations were in attendance. To me, the most important aspects of these meetings are the users reports and, based on the reports that I heard, it appears that MMS is being used successfully at a number of sites. The number of problems and difficulties encountered in using the code seem to be diminishing.

One of the concerns that was addressed at our User Group meeting was what we as users could do to increase membership in the group. We realize that with a larger membership there will be more sharing of experience, more development of useful information on the MMS and MMS-EASE, and more of an effort on B&W's part to further improve MMS. We as members can help by publishing the ways that we have used MMS to solve real plant problems. As other utilities and their contractors see the ways that MMS has been a helpful tool, they too will see the advantage of membership. In our discussion on how the users can increase the membership, we acknowledged that EPRI has a role to play. The staff of EPRI can inform users when they learn of places where the results from the use of MMS can be published.

At the User Group meeting, B&W presented the results of their latest development efforts.

After reviewing B&W's effort, we set forth the priorities for the next development effort. One of the developments that B&W reported was the MMS PC work station. This PC work station combines MMS, ACSL and MMS-EASE on a PC together with certain auxiliary programs. The work station has the advantage that the user does not have to communicate with a large mainframe computer to perform MMS analysis. This will be a significant advantage to those users who do not have easy or inexpensive access to a mainframe and who do have an abundance of PCs in their work place.

Between now and our next users meeting, we will be having our bi-annual election. The Advisory Committee has made the following nominations:

President	Dave Weber	Philadelphia Electric
Vice President	Chuck Arndt	Detroit Edison
Secretary	Al Sudduth	Duke Power
Advisory	Chris Klein	Bechtel
Committee	Ed Bradley	TVA
	Charles Sayles	Southern Cal. Edison

Plans are now being made for our spring MMS User Group meeting. The meeting will be held March 11 and 12 in Rosemead, California and will be hosted by Southern California Edison. (For further information, call me at (818) 302-1756.) I am looking forward to seeing representatives from all users at this meeting.

As I finished writing this, I came to realize that it is my last President's Corner column. I will miss it but will still be very active as a member of the Advisory Committee.

The past two years have been very gratifying, and we have come a long way since the first meeting which was held in March of 1985 in Lynchburg, Virginia.



**CHARLES SAYLES**  
**PRESIDENT**  
November 26, 1986

Major improvements to the MMS have been made by B&W since then, and a great deal of expert assistance has been provided to the members. The structure we established then has served us well and I know I am not alone in thanking B&W for a job well done.

Thank you for your confidence in me and I ask you to please support the new President in every way you can.

**MMS User Group Newsletter**  
**Editors: Phil Bartells (804) 385-2637**  
**Ross Schaack (804) 385-2584**

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