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TRAC CODE DEVELOPMENT STATUS AND PLANS*

by

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ABSTRACT

This report summarizes the characteristics and current status of the TRAC-PF1/MOD1 computer code. Recent error corrections and user-convenience features are described, and several user enhancements are identified. Current plans for the release of the TRAC-PF1/MOD2 computer code and some preliminary MOD2 results are presented. This new version of the TRAC code implements stability-enhancing two-step numerics into the 3-D vessel, using partial vectorization to obtain a code that has run 400% faster than the MOD1 code.

I. INTRODUCTION

Version 12.1 of the TRAC-PF1/MOD1 code was released as the frozen version of MOD1 in January 1985 for the purposes of independent code assessment. The principal features of this code are:

a. A variable-dimensional fluid dynamics model that can address 3-D flow in the vessel component, while the loop components, both primary and secondary, are treated as 1-D flow components. It should be noted that a user can specify a 1-D vessel component, which will result in reduced computer costs.
b. A nonhomogeneous, nonequilibrium full two-fluid six-equation hydrodynamics model that describes the steam-water flow. A horizontal stratified flow model has been added to the one-dimensional hydrodynamics. A seventh field equation (mass balance) that describes a noncondensable gas field and an eighth field equation that tracks the solutes in the liquid phase have also been added to the TRAC hydrodynamics model.
c. A flow-regime-dependent constitutive equation package that describes the transfer of mass, energy, and momentum between the steam-water phases and the interaction of these phases with the heat flow from the system structures.

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* Work performed under the auspices of the US Nuclear Regulatory Commission.

d. Flow-regime-dependent wall-to-fluid heat-transfer correlations that are obtained from a generalized boiling curve based on local conditions.

e. A two-dimensional fuel rod conduction model that includes a dynamic fine-mesh rezoning capability that can resolve both bottom-flood and falling-film quench fronts.

f. Consistent analysis of entire accident sequences, including initial conditions, blowdown, refill, and reflood phases of a loss-of-coolant accident. In addition, TRAC can be used to simulate a complete spectrum of break sizes as well as operational transients.

g. Component and functional modularity which allows the user to model virtually any pressurized water reactor design or experimental configuration. TRAC has component models for accumulators, breaks, fills, cores, pipes, pressurizers, pumps, steam generators, turbines, valves, and vessel with associated internals.

h. Trip and control models that give the user the flexibility to model virtually any PWR control system or protection system or any experimental control system.

Since version 12.1, ten additional error-correction/user-convenience update sets have been generated. These correction sets contain modifications to the TRAC code that can be grouped into three categories. The first group encompasses error corrections to logic and models infrequently activated by the code or users; the second group addresses user-convenience changes that deal with input or output; the third group are new model options that require user input to activate.

Of the updates in the first group, a major error correction improves the interfacial condensation model by limiting its rate of change to that observed experimentally. This replaces the old method of logarithmic-averaging the old and the new time values, which yields time-step-size-dependent results. A significant user convenience is the self-initialization capability added to TRAC. This capability allows the user to input desired initial conditions (i.e. cold-leg fluid temperature, loop mass flow rate, pressurizer pressure, reactor power, etc.) and built-in controls will force TRAC to those user-specified conditions steady state. Another user convenience added to TRAC is the ability to make multiple-component connections to a single cell in a vessel component. This allows the user to reduce the vessel noding for transients in which multidimensional flow in the vessel is not significant, thereby saving computer computation costs.

A major model improvement added to TRAC that must be activated by input is the counter-current flow-limiting (CCFL) model. The user is given the option of specifying a flooding curve for any location within the vessel component for which he/she has experimental data. Since the effective interfacial shear for flooding or CCFL is strongly dependent upon geometry, TRAC will use this user-input flooding curve to infer an effective interfacial shear for those locations for which the user has flooding data. If no flooding data are available, then the user can use the TRAC default interfacial shear package, which will predict a typical flooding curve for a straight pipe. In addition, a new separator model has been implemented into the MOD1 code. This new separator model will have the capability to simulate a separator with a constant efficiency, use the General Electric (GE) mechanistic model to predict carryunder and carryover, or use user-input performance curves to determine the carryunder and carryover.

The TRAC-PF1/MOD2 code is currently under development as the TRAC-PF1/MOD1 code is under maintenance. All error corrections, user-convenience features, and new models developed for MOD1 are also included into the MOD2 code. Therefore, there is a parallel maintenance activity between the MOD1 and MOD2 codes. The 3D SETS method has already been included into the MOD2 code, as has the rewriting of the vessel data base to facilitate the vectorization of the 3D vessel routines.

A new core void fraction distribution model is being developed for the MOD2 code. It is intended that this new model will be able to accurately simulate a wide variety of transient conditions in the reactor core, from reflood to boiloff transients. Since the core void and heat-transfer models are tightly coupled, a new core void fraction model will result in improvements in the TRAC post-critical heat flux heat-transfer package.

A generalized heat-structure capability has been developed for MOD2. This capability will allow the user to model arbitrary conduction paths between any two fluid cells as well as allowing any number of structures to exist in a fluid cell. Heat-structure geometry is two-dimensional and can be specified as either Cartesian or cylindrical. Axial conduction and fine-mesh rezoning capability can be used in any of the generalized heat structures. Generalized heat structures will allow the user more flexibility in modeling steam generators and will improve the modeling of conduction pathways in the vessel component.

The 3-D stability-enhancing two-step (SETS) method has already under gone some developmental testing. One of the tests was a comparison between the current TRAC-PF1/MOD1 code and the 3-D SETS code for a steam generator tube rupture (SGTR) analysis of the H. B. Robinson facility. The calculated results were the same between the two versions of TRAC. However, the 3-D SETS code ran the steady state and most of the transient at ~1/4 the CPU time required by TRAC-PF1/MOD1. Before pump trip the 3-D SETS code was running the transient ~2 CPUs to 1 transient second; it should be noted that this was a very detailed model of both the primary and secondary systems containing 106 components and 621 hydraulic cells with a complete 3-D representation of the vessel and a complete control-system model with 51 signal variables, 209 control blocks, and 72 trips.

II. TRAC-PF1/MOD1 MAINTENANCE AND USER SUPPORT

Since October of 1985, 96 separate update idents have been released as changes to the TRAC-PF1/MOD1 code. Of these 96 updates, 23 were user-convenience updates ranging from adding more comment cards into TRAC to changing the TRAC run-time messages to be more readable. Fourteen of these update idents were associated with improving the portability of TRAC to other computer operating systems. The rest of the update idents fall into the category of error corrections or implementation of new models or user-convenience features (*i.e.*, self-initialization capability, etc.).

User feedback on potential problems with TRAC is obtained through the User Support activity performed at Los Alamos. Over the last twelve months, we have received approximately 800 separate user contacts through the User Liaison staff (Rick Jenks and Paul Giguere). Many of these user problems were solved immediately, such as questions about input or modeling guidelines. Others resulted in improved documentation or actual code updates to fix a code error or implement a user convenience. Of the 800 separate user contacts, ~97% have been solved. The remaining 3% require significant resources to address and therefore are either currently being solved or are scheduled to be addressed in the near future.

In a continuing effort to support TRAC users, a TRAC NEWS newsletter that includes general information, coming events, TRAC update information, assessment summaries, status of TRAC problems, listing of current TRAC-related literature, and updates to existing TRAC documentation (*i.e.*, TRAC User's Manual[1] and TRAC User's Guide[2]) is issued quarterly. In addition, a "trouble-shooting" service is available that gives the user support on his/her problem. These services are available under existing Nuclear Regulatory Commission agreements or on a cost-reimbursable basis for those not covered by existing agreements. The contact person for these services is Rick Jenks, at (505) 667-2021.

III. TRAC-PF1/MOD1 NEW USER CONVENIENCES

A major new user convenience for TRAC-PF1/MOD1 is the self-initialization capability, which allows a user to select a set of desired steady-state initial conditions and uses built-in controllers to automatically drive the steady-state calculation to the desired conditions by adjusting user-specified control parameters. The built-in controllers are proportional and integral controllers that have been developed specifically for this self-initialization capability. Therefore, the gains have been tuned for each of the controllers so that the self-initialization calculation is robust and as fast as is practical. The available controllers are listed in Table I. The specified control parameter that is adjusted is maintained within a minimum value and a maximum value. Therefore, the adjusted control parameter cannot be adjusted into an unrealistic region of operation. The self-initialization capability is available in both the MOD1 and MOD2 codes and has been tested on four different TRAC models (see Table II). Each built-in controller is selected by a single input card.

The use of the self-initialization controllers is demonstrated by considering the H. B. Robinson plant model given in Fig. 1. The steady-state controllers used to obtain the user-desired steady state are given in Table III. Results for the loop 1 and loop 3 cold-leg steady-state controllers are given in Figs. 2 through 5. The loop 1 cold-leg temperature controller uses the steam generator secondary side pressure boundary condition to obtain the user-desired cold-leg temperature. The loop 3 cold-leg temperature controller uses the steam generator fouling factor to obtain the user-desired cold-leg temperature. The user-desired steady-state cold-leg temperatures of ~559 K were obtained in ~700 CPUs. From these results it can be seen that the two methods of adjusting the secondary-side pressure or of adjusting the steam generator fouling factor to obtain a user-desired cold-leg fluid temperature both work well. In Figs. 6 through 8 the results for the feedwater steady state controller are presented. This controller adjusts the feedwater flow control valve to obtain a feedwater flow that matches the steam flow leaving the steam generator. The purpose of this controller is to maintain the secondary-side inventory at the initial user-input value. As can be seen in Figs. 6 and 7, the feedwater flow follows the steam flow quite well. There is one early peak that is not followed exactly; however, the initial inventory is still within 1% of the user-desired inventory. The feedwater flow control valve adjustment is shown in Fig. 8.

A similar steady-state calculation was performed with both the MOD1 and MOD2 codes using the Zion plant model. The primary-side loop flow is shown in Fig. 9 for both the MOD1 and MOD2 calculations. (For Figs. 9-11, the dotted line is the desired condition; the dashed line, the MOD1 result with the steady-state controllers; the solid line, the MOD2 result with the steady-state controllers; the chain-dash line, the MOD2 result of a normal steady state calculation run with the final results of steady-state controllers input at the beginning of the calculation.) The desired primary loop flow is obtained in a relatively short time (~100 CPUs). The adjusted primary pump speed is shown in Fig. 10 for both the

TABLE I

BUILT IN STEADY STATE CONTROLLERS

Controller Type	Component Controlled	Control Parameter Adjusted	Control Parameter Adjusted To Match the Following
1	pump	pump speed	user input mass flow rate.
2	valve	valve position	user input upstream pressure or user input mass flow rate.
3	pump	pump speed	mass flow rate somewhere else in the model. (For example, feedwater flow rate to match steam generator steam flow rate.)
	valve	valve position	mass flow rate somewhere else in the model.
	fill	fill mass flow boundary condition	mass flow rate somewhere else in the model.
4	steam generator	secondary-side pressure or fouling factor.	liquid temperature at vessel inlet
5[a]	vessel	surface roughness or form-loss factor	pressure drop across vessel

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[a] Controller type 5 does not modify the user-input surface roughness or form-loss factor. It does provide the user with the change in form-loss factor or surface roughnes required to obtain the user-desired vessel pressure drop. Therefore, it will be up to the user to decide whether or not to modify the surface roughness or form-loss factor and at which locations.

TABLE II

SELF-INITIALIZATION TEST CASES COMPLETED TO DATE

Plant Name	3D Vessel	# of 1D	# of steady state controllers	Seconds required to obtain steady state
Oconee[a]	yes	35	8	70
Zion[b]	yes	24	6	240
H. B. Robinson[c]	yes	89	10	150
LOFT L2-6[c]	yes	24	5	180

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[a] Run with MOD1 only.

[b] Run with both MOD1 and MOD2.

[c] Run with MOD2 only.

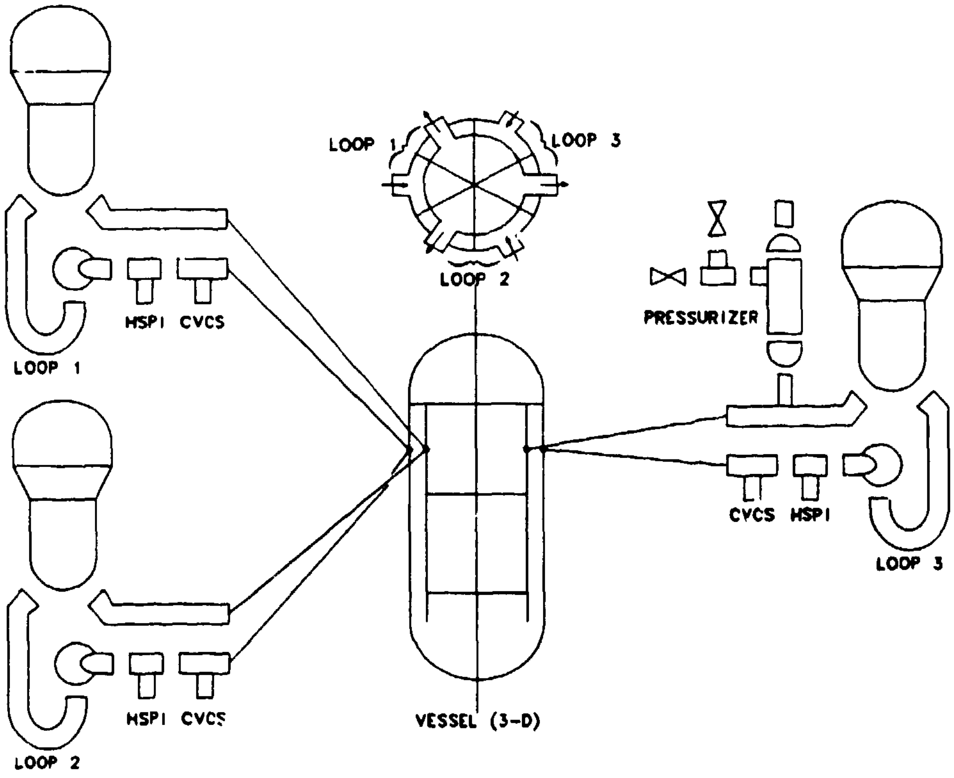

Fig. 1.
Primary system overview for H. B. Robinson model.

MOD1 and MOD2 calculations. Both speeds are slightly higher than the rated pump speed, indicating that either the loop flow resistance is slightly too high or the pump model may be off slightly. The MOD2 pump speed is slightly higher than the MOD1 pump speed. This has been traced to a difference in the methods for solving the momentum flux losses in the upper and lower plena. These two methods are currently under review to determine the correct method. Computer time costs for these two calculations (both included 3D vessel models) are shown in Fig. 11. It can be seen that the MOD2 computer costs are one-seventh of the MOD1 computer costs.

The user convenience of multiple component connections to a single cell in a vessel component is illustrated in Fig. 12. This allows the user to reduce the vessel noding for transients

TABLE III

STEADY-STATE CONTROLLERS FOR THE H. B. ROBINSON UNIT 2 PLANT MODEL

One type 2 controller that adjusts the turbine-valve flow area to achieve a desired upstream secondary-side pressure

for each of the three coolant loops:

Three type 1 controllers that adjust the primary-coolant pump rotational speed to achieve a desired primary-coolant mass flow through the pump.

Three type 3 controllers that adjust the secondary-side feedwater-control valve flow area to achieve a feedwater mass flow through the valve to the steam generator that equals the steam mass flow out of the steam generator.

Three type 4 controllers that adjust the loop 1 secondary-side pressure and loops 2 and 3 steam-generator heat-transfer area fouling factor to achieve a desired loop cold-leg coolant temperature at the inlet to the vessel.

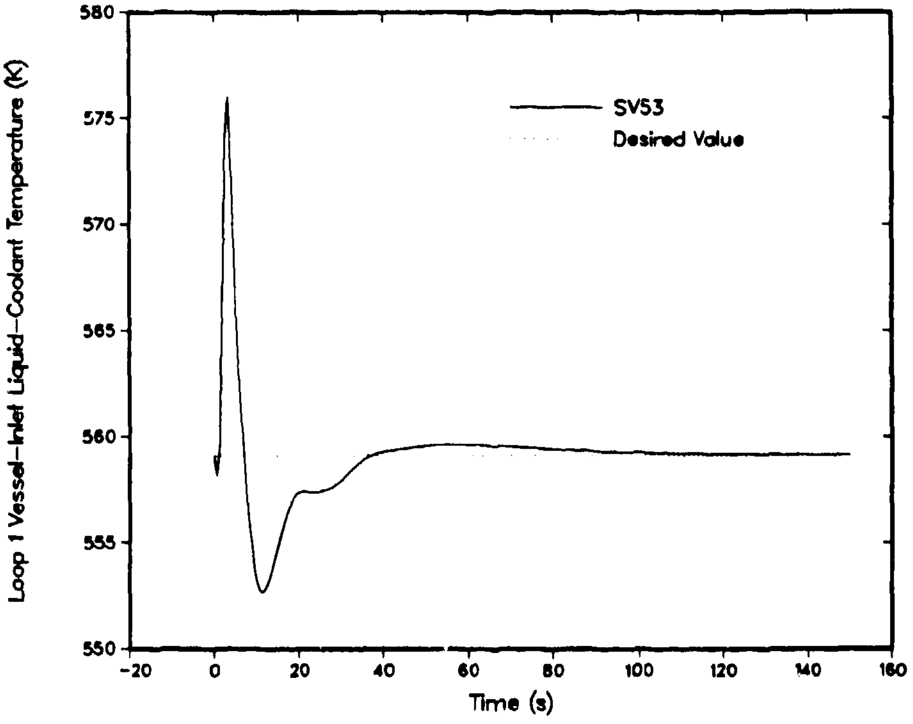

Fig. 2.

Loop 1 vessel inlet fluid temperature for H. B. Robinson.

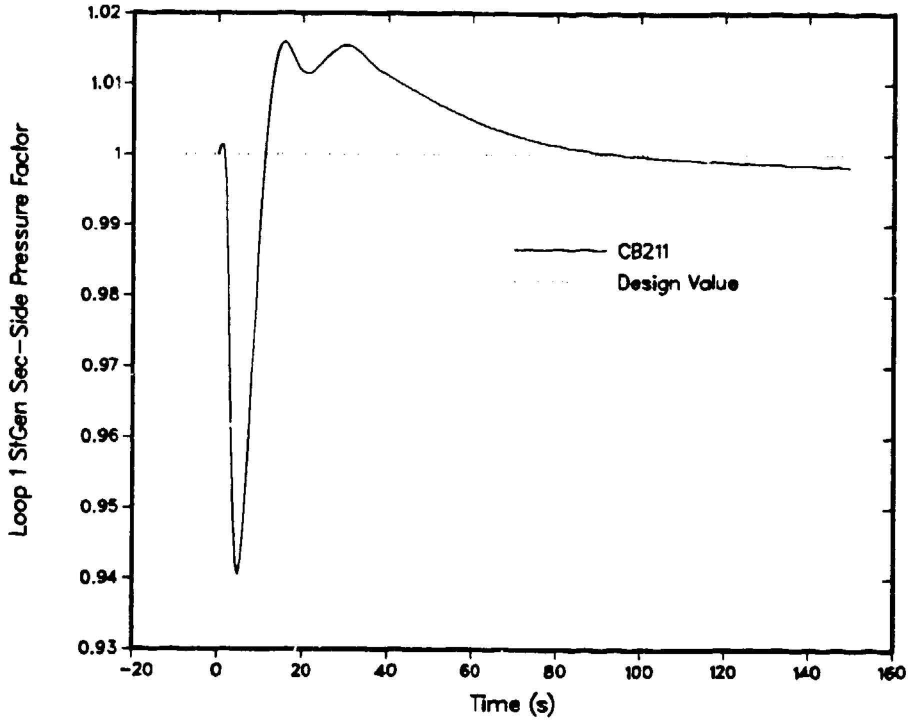

Fig. 3.

Loop 1 steam generator secondary side pressure adjustment factor.

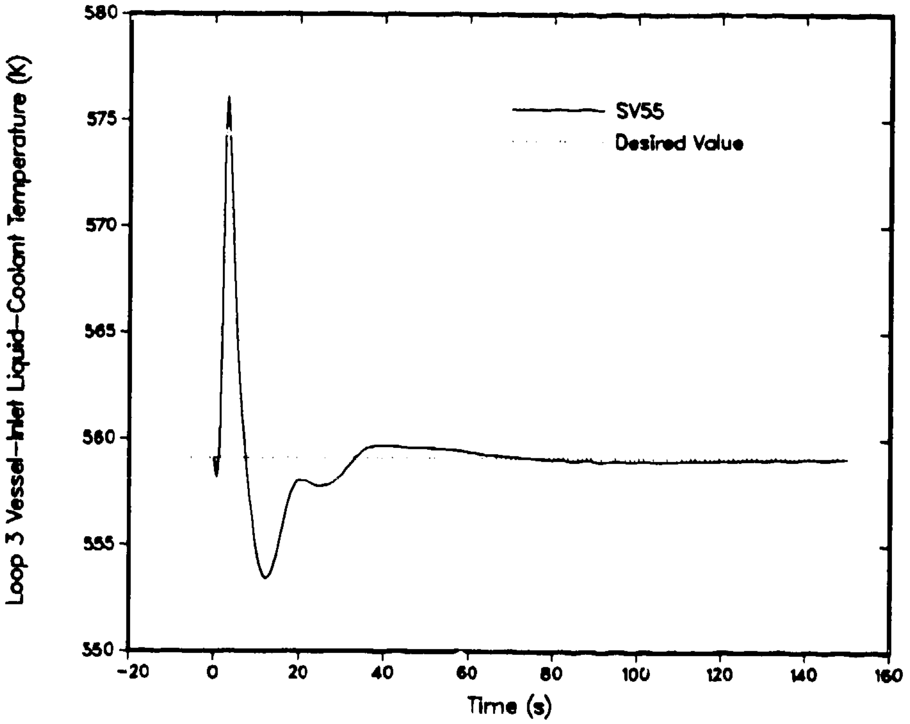

Fig. 4.

Loop 3 vessel inlet fluid temperature for H. B. Robinson.

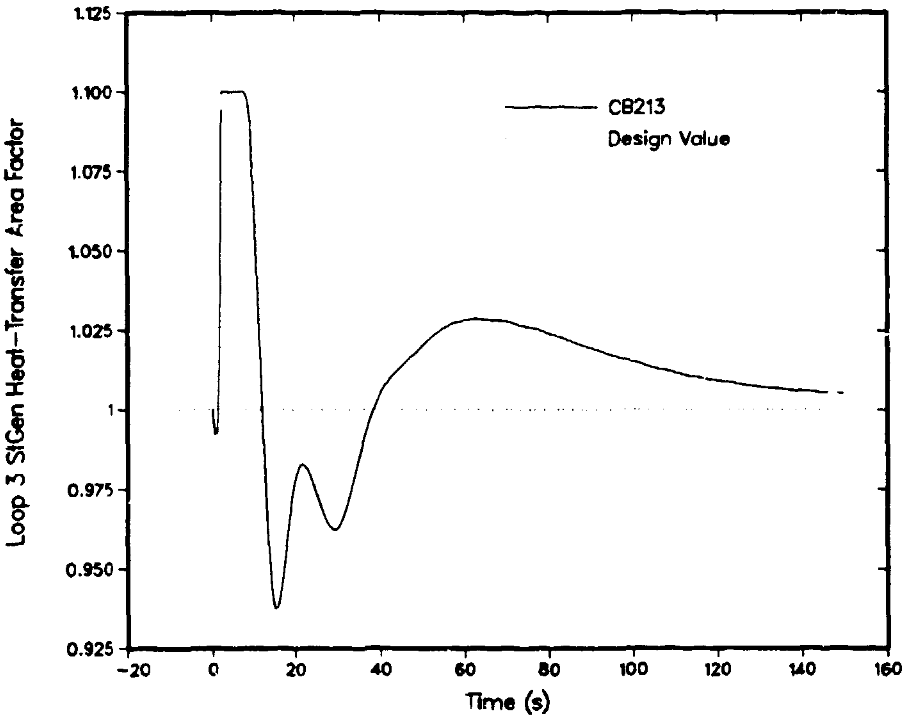

Fig. 5.

Loop 3 steam generator heat-transfer area adjustment factor.

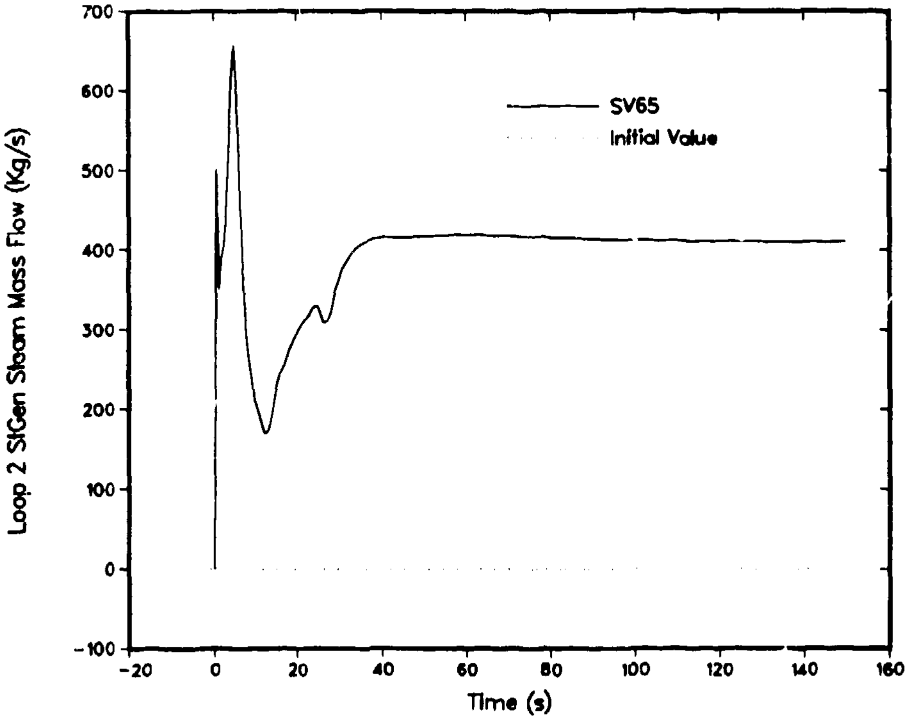

Fig. 6.

Loop 2 steam generator steam mass flow for H. B. Robinson.

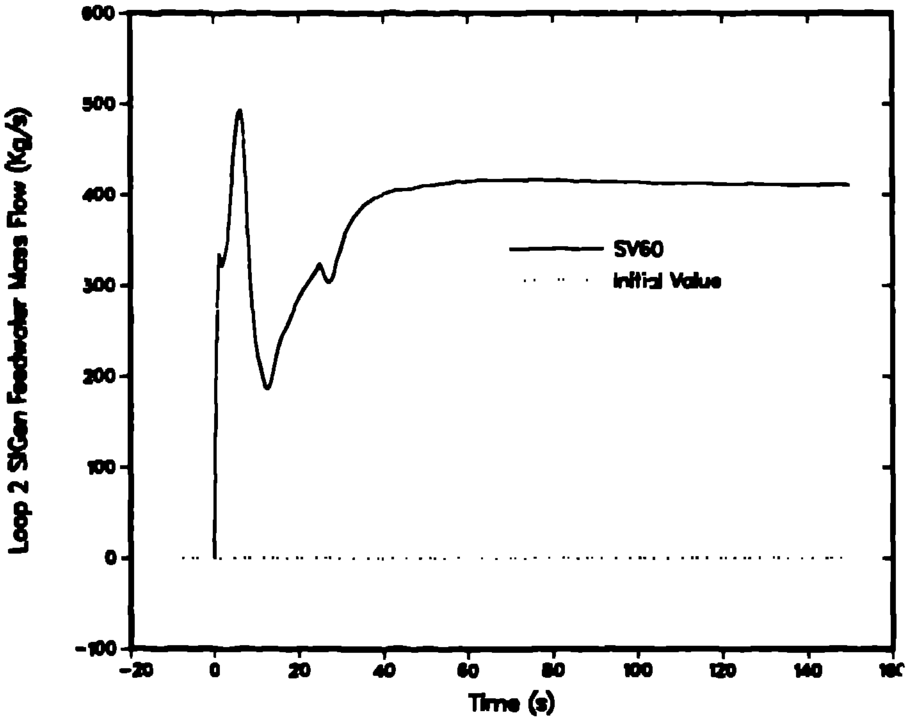

Fig. 7.
Loop 2 steam generator feedwater mass flow for H. B. Robinson.

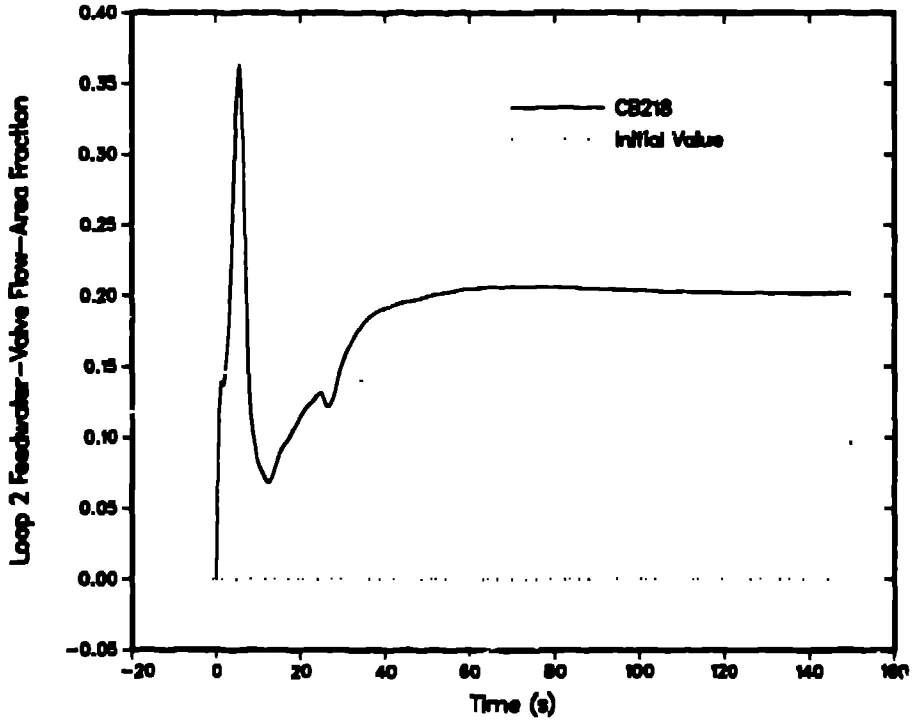

Fig. 8.
Loop 2 steam generator valve flow area fraction for H. B. Robinson.

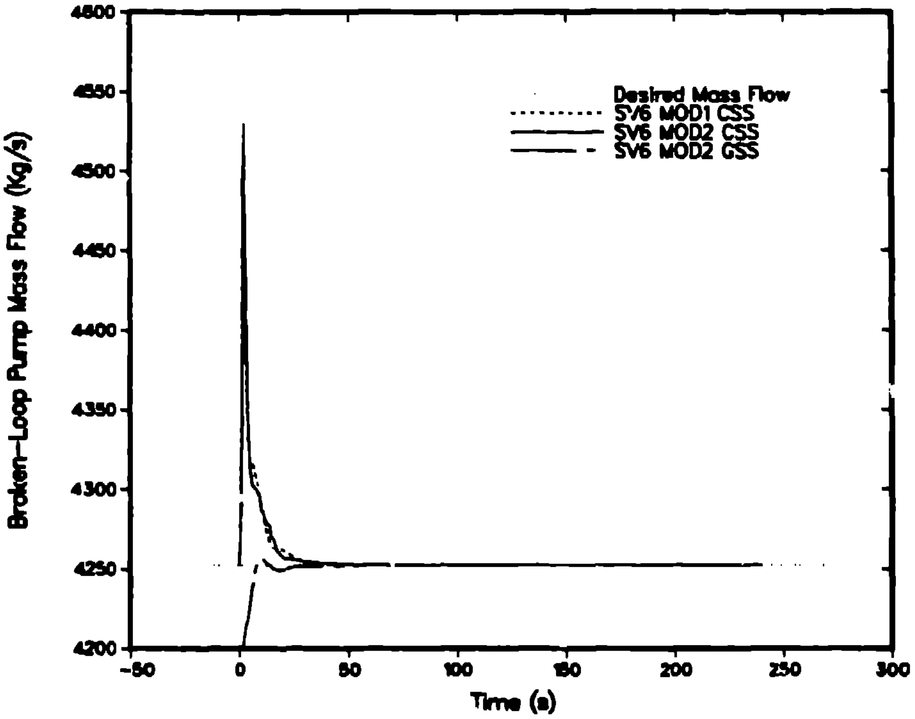

Fig. 9.

Broken-loop primary system pump mass flow for Zion.

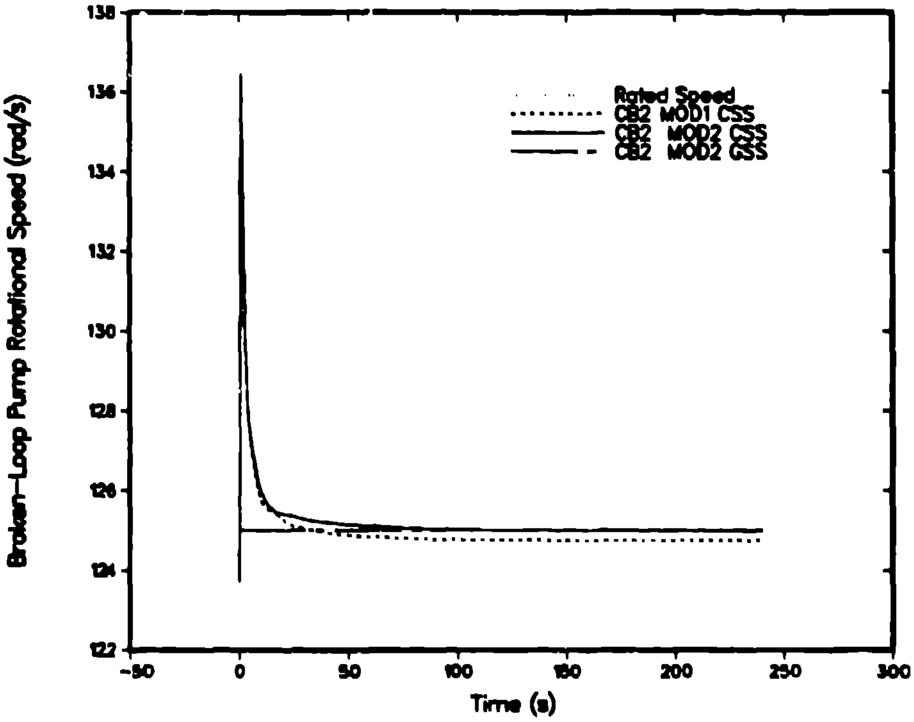

Fig. 10.

Broken-loop primary system pump speed for Zion.

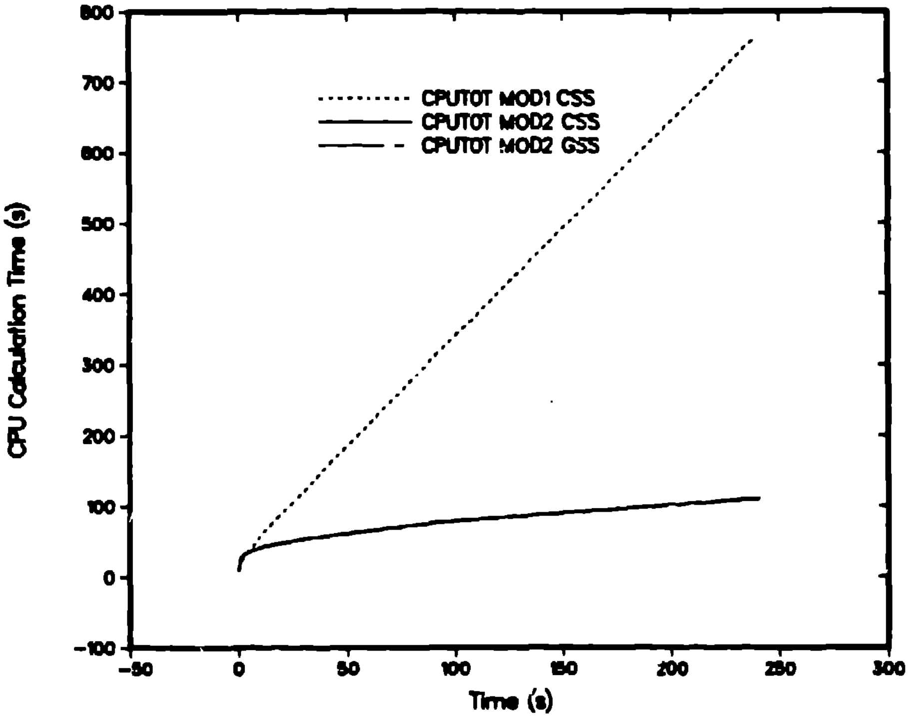

Fig. 11.
CPU calculation time for the MOD1 and MOD2 Zion.

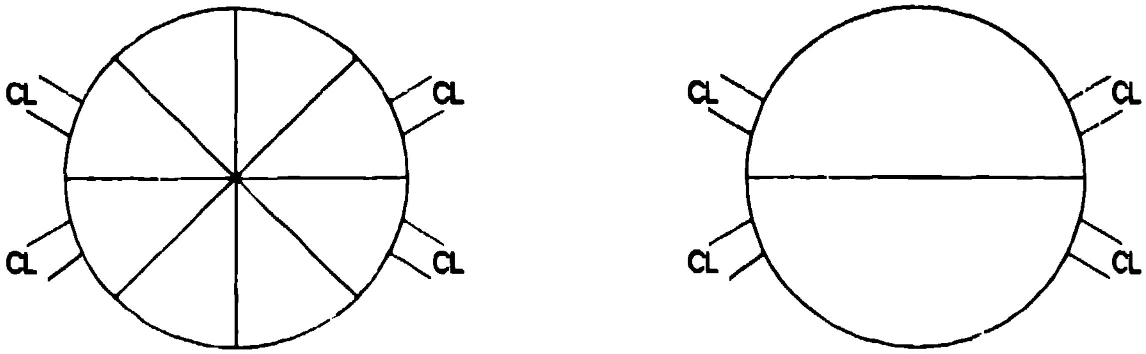

Fig. 12.
Typical fine and coarse vessel nodalizations.

in which multidimensional flow in the vessel is not significant, thereby saving computer computation costs. A typical vessel fine noding and the cold-leg connections for a four-loop plant are illustrated in Fig. 12. The fine noding represented has eight theta sectors with a cold legs connected to four sectors. The coarse noding has two sectors with two cold legs connected to each sector. The coarse noding example for the vessel results in 75% reduction in the vessel nodes. For this type of reduction in vessel noding, the expected computer time cost saving would be ~50% for MOD1.

IV. TRAC-PF1/MOD1 NEW MODELS

A CCFL model has been developed, implemented, tested, and documented for the MOD1 code. This CCFL model adjusts the TRAC interfacial shear to match a user-input flooding curve at user-specified locations. CCFL tends to be very geometry dependent. The current TRAC interfacial shear package does reproduce data for flooding in pipes.[3] CCFL at tie plates or downcomers cannot easily be reproduced by one set of interfacial shear correlations. The new CCFL model in TRAC allows the user to input his/her flooding curve for the geometry of interest. For example, the characteristic flooding curve for the tie-plate region of the vessel is dependent on hole or slot size, number of holes or slots, and upstream and downstream hardware, as well as the properties of the fluid above and below the plate. The new CCFL model in TRAC gives the user the option to model the flooding at specific locations within the vessel with Bankoff's[4] correlation,

$$H_g^{1/2} + mH_f^{1/2} = C \quad , \tag{1}$$

where H_g is the nondimensional gas velocity,
H_f is the nondimensional liquid velocity,
C is the abcissa intercept (note that C^2 is the nondimensional gas velocity at which no liquid can penetrate through the plate, sometimes referred to as the total bypass point), and
m is the slope of the flooding curve.

This correlation allows the user to use Bankoff's correlation if no flooding data are available for the tie plate of interest, a Wallis flooding correlation, or a Kutaladatze-type flooding correlation, depending upon which correlation was used to fit the available data. The different correlations for flooding are determined from the β factor, which is defined as

$$H_k = j_k\{\rho_k/(g\omega\Delta\rho)\}^{1/2} \tag{2}$$

$$\omega = D^{1-\beta}L^{\beta} \tag{3}$$

$$L = \{\sigma/(g\omega\Delta\rho)\}^{1/2} \quad , \tag{4}$$

where j_k is the superficial velocity for phase k (m/s),
D is the hydraulic diameter (m),
g is the acceleration of gravity (m/s^2),
σ is the surface tension (Nt/m),
ρ_k is the density for phase k (kg/m^3),
$\Delta\rho$ is $\rho_f - \rho_g$ (kg/m^3), and

β is a correlation constant.

Note that for $\beta = 0$, the correlation reverts to the Wallis flooding correlation and for $\beta = 1$, the correlation reverts to the Kutaladatze flooding correlation. The determination of β for the Bankoff correlation is given in Ref. 4. For TRAC input, the user has to provide only m, C, and β, and the locations in the vessel component at which the model is to be applied.

In Fig. 13, MOD1 with and without the new CCFL correlation is compared to saturated steam-water data taken from Ref. 4. From these results it can be seen that the new model is a significant improvement over the unmodified TRAC code. In Fig. 14, MOD1 with the new CCFL correlation is compared to subcooled steam-water data taken from Ref. 4. From this plot it can be seen that TRAC is doing a good job of reproducing the weep point (the steam flow at which water begins to appear below the plate) and the dump point (the steam flow at which water begins to dump through the plate). The results in Figs. 13 and 14 were obtained with the same input for the flooding curve; there were no modifications to account for condensation effects within the correlation itself. In TRAC, the user-input flooding curve is used to infer interfacial shear coefficients for counter-current flow through the plate. TRAC already accounts for condensation by means of the interfacial heat transfer correlations. Prediction of the data given in Fig. 14 is not only a test for how well the interfacial shear is being predicted, but also for how well the interfacial heat transfer is predicted, since subcooled CCFL couples very closely with both of these effects.

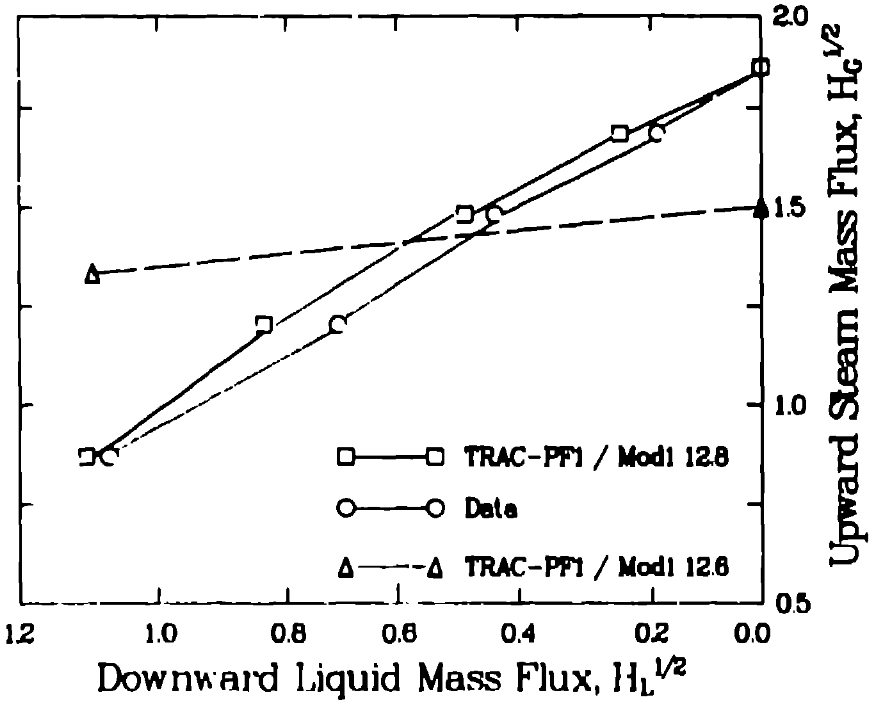

Fig. 13.

Saturated steam-water CCFL results for perforated plate, 15 holes.

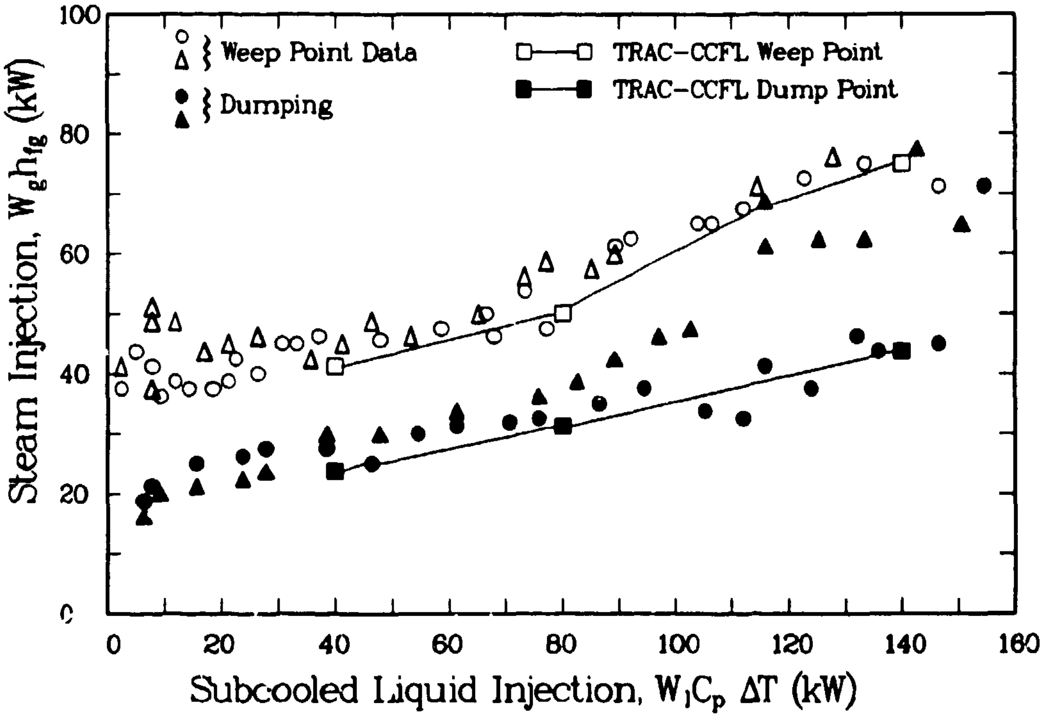

Fig. 14.

Subcooled steam-water CCFL results for perforated plate, 15 holes.

In addition to the CCFL model, a new steam-water separator model is being developed for the TRAC-PF1/MOD1 code. This new model separator has been implemented into the MOD1 code and testing is currently in progress. The model will give the user the capability to input a constant separator efficiency, to use the GE mechanistic separator model to determine the carryover and carryunder, or to use user-supplied performance curves. This development effort is based on the TRAC-BWR (Ref. 5) separator model.

V. TRAC-PF1/MOD1 DOCUMENTATION

A new version of the TRAC-PF1/MOD1 code will be released in March of 1987. This version will include all known and available error corrections for the MOD1 version of TRAC-PF1. It will also include the self-initialization capability, the multiple source capability, the new steam-water separator model, and the new CCFL model. Released with this new version of the TRAC code will be a complete set of supporting documentation. This complete set of documentation has been defined to be the following documents.

a. TRAC User's Manual.[1]
b. TRAC User's Guide.[2]
c. Assessment Documentation.[6]
d. Methods and Correlations Document.
e. Applicability and Scalability Document.

The Methods and Correlations and the Applicability and Scalability documents are two new documents. The first three documents have already been released for the MOD1 code.

However, the User's Manual and User's Guide are being updated by means of the TRAC NEWS newsletter as new models or new guidelines are developed. The new documents are companion documents that attempt to address the issue of scaling of the TRAC results to large-scale facilities. The Methods and Correlations document identifies each correlation and method in the TRAC-PF1/MOD1 code, documents how each of those correlations and methods has been implemented into TRAC (*i.e.*, what assumptions were used and what approximations were used), identifies the basis or data base for the correlation or method, and attempts to address the scaling of the individual correlation or method. The Applicability and Scalability document will identify the dominant phenomena for a specific accident scenario and use the Methods and Correlation document results and available assessment results and uncertainty analysis to address whether or not TRAC will scale for that specific accident scenario. These two documents are currently in progress at Los Alamos.

VI. TRAC-PF1/MOD2

The TRAC-PF1/MOD2 code already includes the 3D-2 Step method, that allows for large time-step sizes to be used during portions of transients when the time scale for the dominant phenomena is long. In addition, the vessel component in the MOD2 code has been partially vectorized, resulting in significant reductions in all transient analyses that include multidimensional TRAC vessel components. Some preliminary assessment of the MOD2 code with the 3D-2 Step method has been completed.

Figure 15 shows the primary-system pressure predicted by both the MOD1 and MOD2 codes for a SGTR analysis. Both the MOD1 and MOD2 codes predict a slow decrease in the primary pressure as fluid leaves the primary system through the broken steam-generator tubes. The time at which the low pressure set-point trip is reached is slightly different in the two calculations because of different calculated pressure losses through the vessel. The different pressure losses through the vessel are due to the difference in methods used to model the change in momentum flux in the lower and upper plena, and the correct method is currently under investigation. After reactor scram, the primary pressure falls almost to the secondary-side pressure and tends to follow the secondary-side pressure, which is increasing as a result of the isolation of the secondary side of the steam generator, as can be seen in Fig. 16. The flow through the SGTR location is plotted in Fig. 17 and again both codes are given the same results except for the timing of the reactor trip. The total CPU costs are shown in Fig. 18 and it can be seen that the MOD2 CPU cost was approximately one-third that of the MOD1 CPU cost. During the first 250 s of the transient, the MOD2 CPU cost was approximately one-fifth the MOD1 CPU cost.

Two major model improvements are planned for the MOD2 code, which will be released in the summer of 1987, after developmental assessment has been completed. The core void distribution model in TRAC will be improved. Currently the MOD1 code includes an interface sharpener model in the core region of the vessel component. Comparisons to experimental data from the Slab Core Test Facility and the Cylindrical Core Test Facility indicate that the MOD1 interface is too sharp (too much water remains in the lower half of the core and not enough water is carried into the top of the core and into the upper plenum). This work involves removal of the interface sharpener model and replacing it with better flow-regime maps for reflood and improved entrainment models. This work is currently in progress.

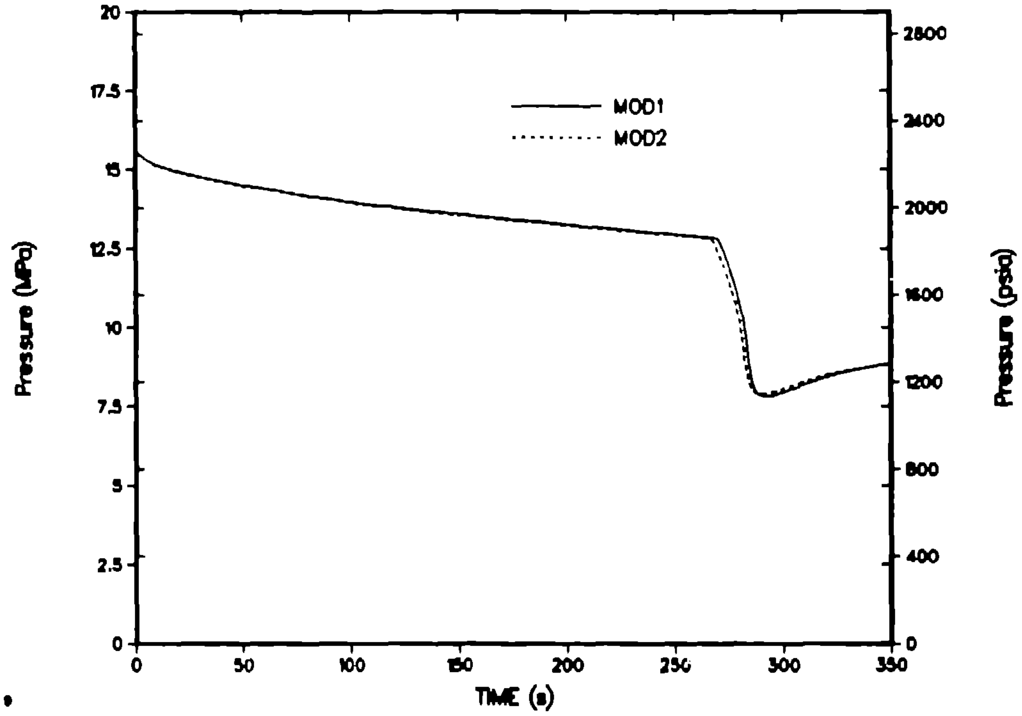

Fig. 15.
SGTR primary pressure.

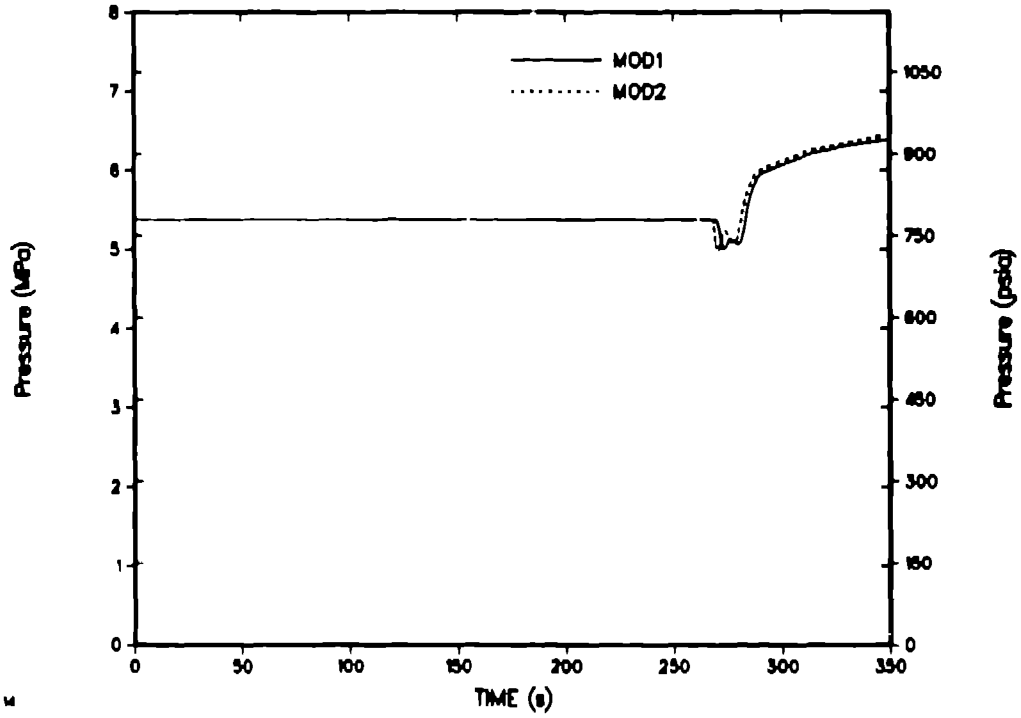

Fig. 16.
SGTR secondary side pressure.

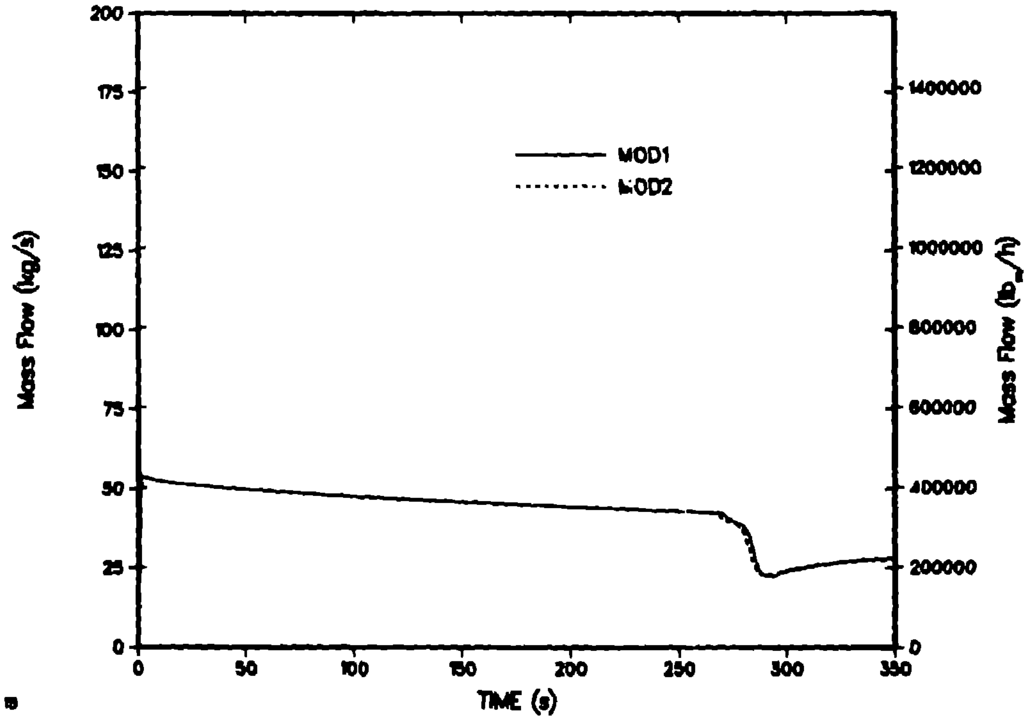

Fig. 17.
SGTR mass flow.

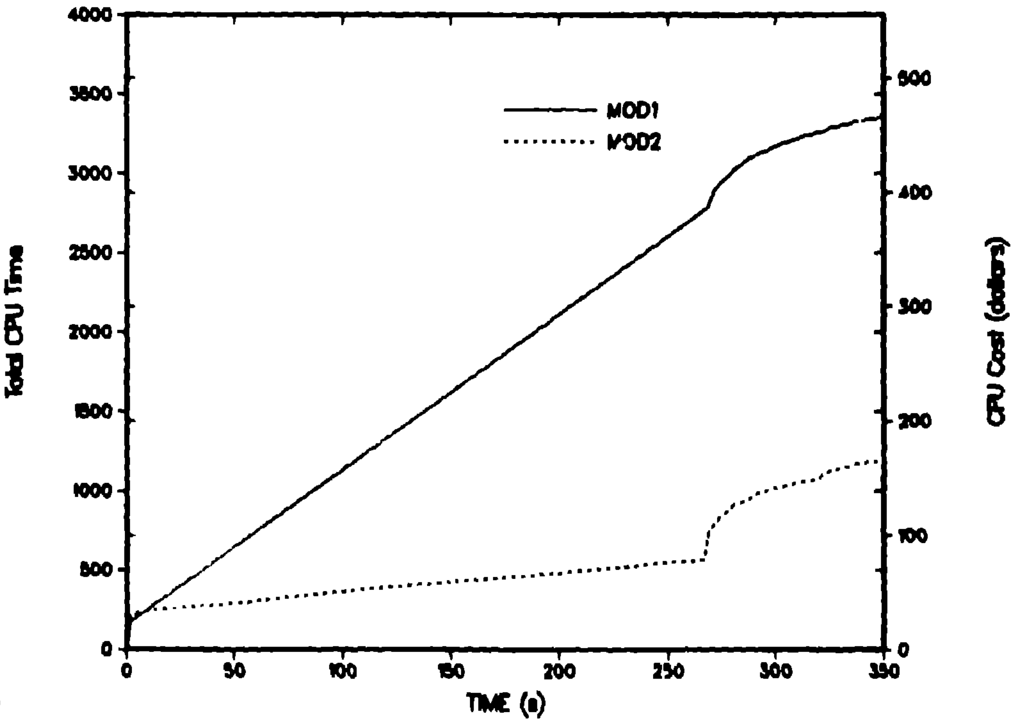

Fig. 18
MOD1/MOD2 Cray CPU time for SGTR analysis.

The other major model improvement for the MOD2 code is an improved entrainment/de-entrainment model in the upper plenum. Assessment to date indicates that when the correct carryover from the core region is predicted and reasonable noding is used in the upper plenum, then TRAC calculates too much entrainment in the upper plenum and not enough de-entrainment. Work is currently in progress to develop de-entrainment models and/or improved flow-regime models for the upper plenum.

VII. TRAC-PF1/MOD3

A plan is currently being developed for the development of a TRAC-PF1/MOD3 code to be released in 1990. Many of the current problems with TRAC can be traced to the prediction of flow regimes and the prediction of the transition time and location from one flow regime to another. A proposal currently being developed is the implementation of mechanistic flow-regime models (*i.e.*, separate transport equations to determine the transport of interfacial area of drops or bubbles) into the TRAC code. Mechanistic flow-regime models should improve our ability to predict the time scale associated with a flow-regime change.

A general model for condensation that is applicable to a wide range of geometries and flow regimes has not yet been developed. A proposal is in progress that addresses this problem area in TRAC. Quick fixes that have been implemented into TRAC over the years tend to improve the model for one or several sets of geometries and flow regimes. Together with the new flow-regime models, it is anticipated that a new condensation model could be developed that is general enough to address the accident analyses of interest

Complete vectorization of the TRAC code would result in a significantly faster-running computer program as well as a program that is easier to read, understand, and maintain. In addition, a vectorized program is easier to modify to take advantage of parallel processing machines.

VIII. CONCLUSIONS

The TRAC-PF1/MOD1 code continues to be improved and enhanced as we continue to receive user feedback about the code. The new user conveniences and models developed for the MOD1 code result in significant improvements in TRAC's user friendliness as well as its accuracy. The current document plans for MOD1 will result in identifying when and where the TRAC-PF1/MOD1 code should be used and what its expected accuracy is. The TRAC-PF1/MOD2 code, which will include all of the new models in the MOD1 code, will be faster than the MOD1 code and have improved models and methods for reflood analysis. A proposal for a MOD3 code is currently in progress. The MOD3 code will be faster and more efficient than the MOD2 code and will include improved flow regime and condensation models that will be scalable and more accurate.

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