# DEVELOPMENT AND APPLICATION OF THE COMPUTER CODE CAPS (COMPUTER AIDED PIPING-ANALYSIS SYSTEM)

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**ABSTRACT**

It takes the Beijing Institute of Nuclear Engineering (BINE) more than ten years to have developed CAPS as a powerful computer code for the evaluation of pipe system in nuclear power plants since 1992. The introduction of the development of the code and its application in the nuclear power plants in China were presented here which mainly focus on the useful capabilities of management and graphic. In resent years more blocks were added gradually into the code besides the blocks for pipes, such as the evaluation of linear supports and flanges etc., and these blocks were also introduced in this article.

**Keywords:** pipe analysis    management    graphics

## 1. INTRODUCTION

Generally, there are thousands of pipe lines to be analyzed in a nuclear power plant, and usually the layout of the pipe lines might be changed during the procedure of the build of a plant, that makes it difficult to manage the data files for the calculation of the pipe lines. So, the computer code – CAPS was developed. Actually, CAPS is a container of all the codes needed in the calculation of the pipes and provides additional function to manage the data files and promote the efficiency of the analysis of the pipe lines. In resent years more blocks were added gradually into the code besides the blocks for pipes, such as the evaluation of linear supports and flanges etc. Now, CAPS has become a useful Computer Aided Piping-analysis System. The main features were introduced briefly in this article below.

## 2. HARDWARE PLATFORM

The hardware platform for CAPS is shown in Fig.1. CAPS was installed on a workstation. Users run CAPS through terminal computers. The data are saved on the workstation and managed by CAPS.
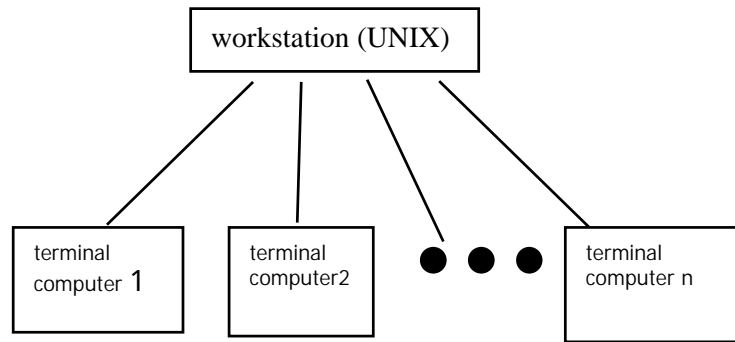
*Fig. 1*

## 3. OPERATE INTERFACE

Texture menu system was used for the interactive interface of CAPS.   Users call on the functions by type the corresponding key letters. Fig.3-1 gives examples of the menus. Before the development of CAPS, the code used in pipe analysis were divided into many programs, and were called on by type the names of the code and the names of the data files.   CAPS made these things easier thought the menu system.

## 4. FUNCTION FOR DATA MANAGEMENT

The function of data management is the main function of CAPS. When users use CAPS, a small database is built automatically record the main information for the data file such as the name of the user, the plant, the system, and the pipeline, the date, the version of calculation, the code name for which the data file is prepared for, and so on. The real name of the data files were managed by CAPS automatically, so as to avoid two data files having the same name. User can find any specified data file quickly using the information recorded in CAPS and use the file. Using CAPS one user can not edit the files built by other person, but can view and copy them.

## 5. FOUNTION OF PREPROCESS

A code named AMP is the preprocess code used in CAPS. AMP provides a simplified way to prepare the input data file. User does not need to hand generate the meshes. The code will generate the meshes automatically using the geometry data in input files.

## 6. FUNCTION OF GRAPHIC

The result data are not easy to be used in their original format. So, the function of graphic was developed which make it easier to find the useful information quickly. The types of graphic in CAPS are listed as follow:
- geometry display
-  displaced shapes display
- reaction force display
- stress distribution display
- stress ratio display
- modal shape display
- spectrum curve display
- other graphic, such as shape of flange, etc.

These graphic displays give much help to users to analyze pipe lines. Fig.2 shows some cases of these types of graphic.
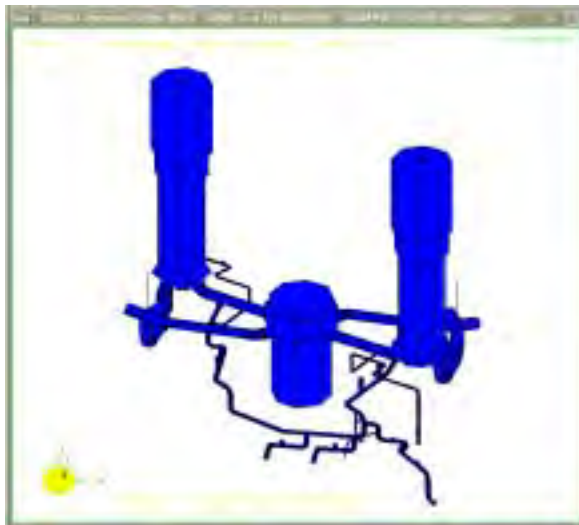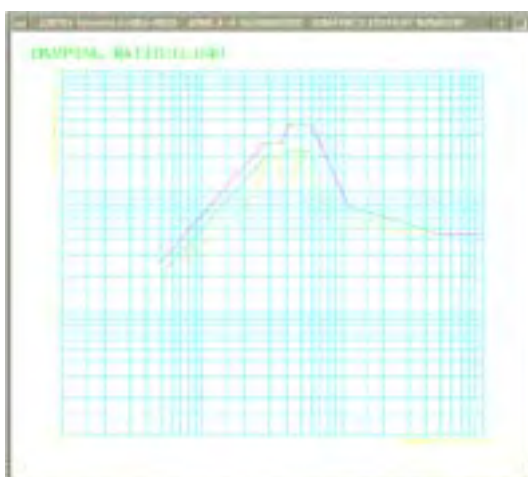
a    Geometry display


b    Displaced shapes Display
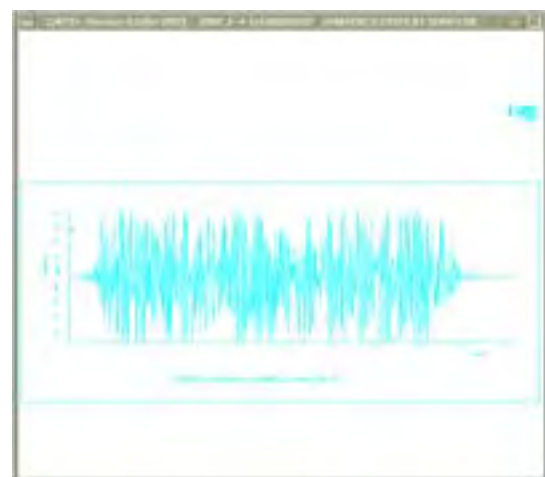

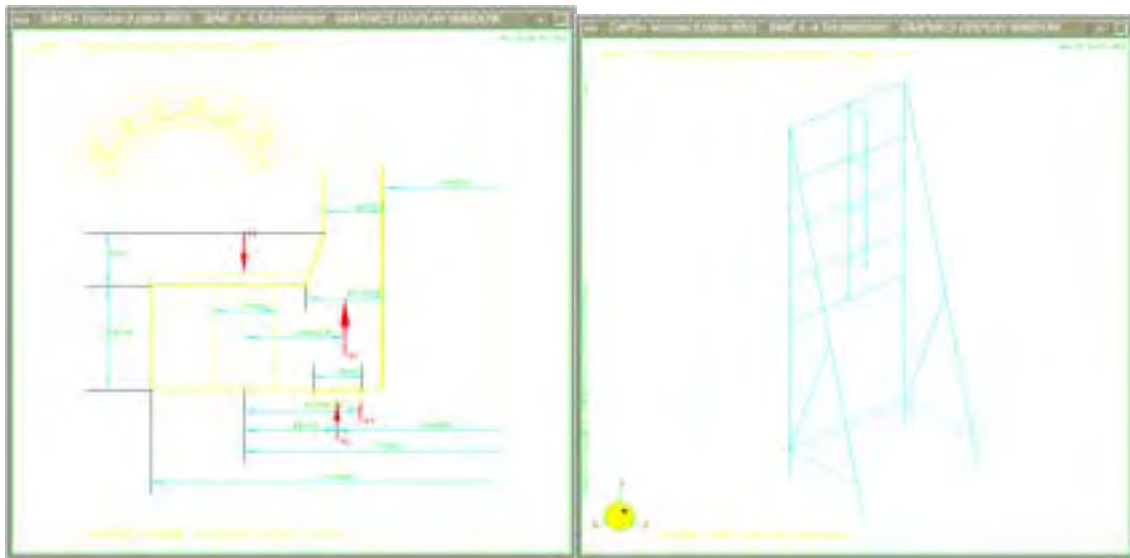（c）Stress distribution display


(d) Reaction force display


e    Spectrum curve display


f    Time history display

(G)Flange                                    (H) Support

*Fig.2*

## 7.FUNCTION OTHER THAN PIPE ANALYSIS

In resent years more blocks were added gradually into the code besides the blocks for pipes. The data files used by these blocks are managed by CAPS. CAPS also provide graphic display for these codes.

## 8.APPLICATION

CAPS has been used in pipe lines analysis since 1995. The total number of the data files managed by CAPS in QINSHAN PHASE    was listed bellow in Table 1. Now   user can find any one of these data files easily using CAPS by the name of the plant and the system which the pipe line belongs to.

*Table 1*

| year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 |
|------|------|------|------|------|------|------|------|
| total number of the data files number | 34 | 118 | 200 | 112 | 164 | 158 | 105 |

## 9.CONCLUSION

CAPS have become a powerful computer code for the evaluation of pipe system in nuclear power plants. It promoted the efficiency of the analysis of the pipe lines. The useful capabilities of management and graphic are still play important roles in the analysis work.