ANALYSIS OF HIGH FREQUENCY AND MULTIPLE-SUPPORT EXCITATION PROBLEMS WITH KWUROHR

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SUMMARY

The demands on the dynamic analysis capabilities for piping systems have in the past two years called for increases in the number of degrees of freedom of the structural system, the number of frequencies and the number of input spectra to be considered in the response spectrum computation. This is due to the increased complexity of the piping systems to be analyzed, the inclusion of aircraft accident loads, in addition to seismic loads, in the nuclear power plant component safety computations and the recent trend to remove the excessive conservatism present in using the envelope of multiple input spectra.

These computational capabilities have been programmed into KWU's digital program KWUROHR (Rohr = pipe) which has been developed from UC-Berkeley's general purpose SAP-IV program. In an initial phase a geometric preprocessor, a graphics program, a stress analysis postprocessor conforming with the ASME-Code, Section III requirements, and a number of user-oriented features were added.

In the current programming effort considerable changes in the secondary storage strategy of the program had to be made to accomodate the larger amount of data. Where the original program would hold the information in core, a blockwise dumping of information on magnetic disc was introduced, thus removing several of the size restraints of the earlier program version.

Concurrently several user-oriented features have been added to the program. These include (1) automatic bandwidth optimization using the Collins algorithm, (2) integration of the geometric preprocessor into the analysis program, also allowing circular systems to be generated from incremental coordinates, (3) automatic restraint of auxiliary nodal points not connected to the structure, (4) automatic generation of boundary elements for computing static and dynamic support reactions and for modeling support springs, (5) kinetic and potential energy checks for additional user confidence, (6) stiffness elements for modeling bellows and compensators, (7) additional error messages and selective output. All of these program features have been implemented on Telefunken and Control Data equipment.

Examples are presented of computations executed with the improved program at the AEG/Telefunken TR440 computer center in Frankfurt (M).