METHODS FOR IDENTIFICATION OF DYNAMIC PARAMETERS OF MATHEMATICAL-STRUCTURAL MODELS FROM EXPERIMENTAL DATA

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SUMMARY

The dynamic analysis of complex and critical structures, such as nuclear power plants, must not only employ both theoretical and experimental analysis, but also combine these two approaches to provide a unified description of the structure. A theoretical a priori model is useful in planning a vibration test, while the data obtained from such testing can be used to modify the a priori model so that it reproduces the experimental data.

This paper illustrates several mathematical methods useful in planning the placement of excitors and accelerometers; analyzing data to identify resonant frequencies, modal damping and mode shapes; modifying the mass and stiffness properties of the a priori model (and consequently indicate improved methods of modeling in future studies); and identifying unknown forces acting on the structure, once a good model has been obtained.

Central to these methods is the use of a generalization of the inverse of a matrix - the pseudo-inverse and the availability of efficient computer software for its computation. The properties of the pseudo-inverse allow it to calculate weighted least-mean-square and weighted minimum-norm solutions to ill-conditioned linear systems. It is consequently a versatile tool in the analysis of vibrating systems where the number of measurement and forcing points are often different and the confidence in different measurements and models varies.