COMPARISON OF MODELS FOR SOIL-STRUCTURE INTERACTION

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SUMMARY

Earthquake response of nuclear power plant structures on deep soil sites is computed using different soil-structure interaction models and different methods of analysis.

Model 1: represents the soil by constant springs and dashpots.
Model 2: represents the soil by constant springs and frequency dependent dashpots.
Model 3: uses frequency dependent springs and dashpots based on half-space theory.
Model 4: uses a finite element representation of the soil.

Models 1 and 2 are treated by time history modal analysis, while Models 3 and 4 are analyzed in the frequency domain through Fast Fourier Tranformations. Hysteretic material damping and frequency dependent radiation damping are conveniently handled by the latter method.

Model 4 consists of an axisymmetric finite element discretization for non-axisymmetric loading conditions. Embedment of the structure, layering of the soil and the virtually infinite lateral extent of the subgrade (permitting radiation damping) are accounted for by this model.

Comparison of the computed response shows that in many cases Models 1 and 2 yield results in good agreement with those obtained by the more refined Models 3 and 4 if modal damping is included properly in Models 1 and 2.

The suitability of the different models and methods of analysis is discussed with respect to accuracy, time and cost. Consideration is given to the complications resulting from coupling of adjacent structures, soil behaviour and the complex nature of earthquake excitation.