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STUDY OF SOLID FLUID INTERACTION OF DAMRESERVOIR USING FINITE ELEMENT TECHNIQUE

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Abstract

Solid-fluid interaction problems are solved by Finite Element method based on either of the two approaches: viz.(i) displacements as the variables in solid and pressures (velocity potentials) as thevariables in fluid, or (ii) displacements as the variables in both fluid and the solid. In the current investigation, a computer software has been developed for the frequency analysis of solid-fluid interaction problems by finite element formulation in which displacements are chosen as the only variables at each node both in solid and fluid. The formulation includes the effect of large displacement in solid and fluid, thus making the problem a non-linear one. The surface potential terms (during sloshing) are added to the fluid stiffness by which the low frequency fluid sloshing modes are excited. Isoparametric 4 noded, 8 noded and 9 noded 2-D elements and 8 noded and 27 noded 3-D elements are employed in the finite element formulation. The technique of reduced integration for the gauss points has been applied such that the element becomes flexible within the fluid. However, this introduces spurious zero energy nodes. This problem is overcome by introducing rotational constraints. A Dam-reservoir problem was analysed and the natural frequencies were obtained. In all these cases the present formulation brings out all the possible modes of vibration both sloshing and
rotational, without missing any.

Keywords: Finite element, solid-fluid interaction, Dynamic, Eigen values