

## Dam-Reservoir-Foundation Interaction in Time Domain

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**Key Words:** *Dam-reservoir-Foundation, Interaction, Gravity Dam, Exact solution*

### ABSTRACT

A dynamic exact solution in time domain for transient response of (flexible) structure-(infinite) reservoir - (flexible) foundation is presented. Exact consideration of the radiation condition of the infinite reservoir and deformation of dam structure and flexibility of foundation are included in the formulation which explicitly expresses the physical phenomena of fluid-structure-foundation system. The dam is modeled as a cantilever beam. Thickness of dam is assumed to be variable.

The analysis of non-prismatic beams by the displacement based formulations (stiffness method) is inherently approximated due to the fundamental assumptions of the displacement fields in those methods which usually lead to the violation of one of the three fundamental equations namely: equilibrium equations, compatibility of strain-displacement, constitutional law of material behaviour as the necessary and sufficient conditions for the problem solution.

To overcome this problem a flexibility based formulation (force method) has been employed. A new method of consistent mass matrices for non-prismatic Euler-Bernoulli beam elements based on principles of structural mechanics is used to analyze the structure of the dam.

The new formulation that is applied in this paper is based on the implicit derivation of exact shape functions. Using this method, the stiffness and consistent mass matrices of these beams have been obtained in an exact fashion, and the vibration properties of the beam have been extracted.

The hydrodynamic pressure in the fluid domain of the structure-reservoir system is modeled by pressure wave equation.

Dam structure is assumed flexible, water compressible and non-viscous and elastic foundation modeled by lateral and rotational springs.

Interactive behaviour of the dam-reservoir-foundation system with different geometrical properties is demonstrated by numerical examples when the system is subjected to ramp acceleration and El Centro earthquake ground motions.

The comparison of transient response of the system of empty and full reservoir and flexible and rigid foundation with various research works and EAGD-84(Chopra & Fenves1984) is also presented that shows the competency of the proposed method.

### **REFERENCES**

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