

Assessment of Foundation Mass and Earthquake Input Mechanism Effect on Dam-Reservoir-Foundation System Response

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Abstract

Concrete dams are one of the most important infrastructures in every country and the seismic safety assessment of them is a major task in dam engineering field. Dam-foundation-reservoir system analysis is a complex interaction problem because this system consists of three domains with different behaviors. For accurate analysis of this system some important factors should be considered such as foundation mass and earthquake input mechanism. In this paper the effect of foundation mass and earthquake input mechanism on seismic response of concrete gravity dam is investigated. For this purpose, 2 different methods are introduced for modeling of massed semi-infinite foundation in finite element method namely, Free-Field Boundary Condition (FFBC) and Domain Reduction Method (DRM). To verify the feasibility of proposed methods for seismic analysis of dam-foundation-reservoir system, the displacement and stress outputs using proposed methods are compared with EAGD-84 results. The obtained results indicate that both methods are accurate enough for finite element modeling of massed foundation. Finally, Koyna concrete gravity dam is analyzed for rigid, massless and massed foundation cases using DRM and it is concluded that the foundation has significant effect on dam response and the common massless foundation approach overestimates the dam response.

Keywords: Soil-Structure Interaction, Free-Field Boundary Condition, Domain Reduction Method, Massed Foundation, Boundary Condition, Seismic Wave Propagation, Radiation Damping.