

# **Seismic Response Analysis of High Arch Dams to Spatially-Varying Ground Motions**

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## **Abstract**

The failure of a large dam can be catastrophic to human life and property downstream. Therefore, the seismic safety is of particular concern for high dams in seismically active regions. This paper addresses the seismic response analysis of high arch dams due to spatially-varying ground motions. Firstly, a comprehensive analysis model developed at Tsinghua University is presented, which takes into account radiation damping effect of semi-unbounded canyons, dynamic interaction of dam-water, opening of contraction joints, seismic damage cracking and strengthening of dam concrete, and nonlinearity of foundation rock. Subsequently, the seismic damage of Pacoima dam during the 1994 Northridge earthquake is qualitatively analyzed by the developed analysis model. The results agree with the actual damage observed after the earthquake. Most of the contraction joints opened and closed during the earthquake, and a larger residual opening occurred at the thrust block joint after the earthquake. The cracks continue from the bottom of the thrust block joint in three directions: diagonal, horizontal, and vertical. Finally, a large-scale numerical simulation of seismic ground motion from source rupture to dam canyons is introduced, which can simulate the characteristics of near-field ground motions at dam sites by considering the effect of source mechanism, propagation media, and local site.

**Keywords: Concrete Dam, Seismic Damage, Spatially-Varying Ground Motion, Source To Site.**