9thInternational Congress on Civil Engineering,May 8-10, 2012
Isfahan University of Technology (IUT), Isfahan, Iran

Effect of base-rock characteristics on non-linear seismic respons of concrete gravity dams including dam-foundation interaction

Soroush Resatalab[1*] , Reza Attarnejad[2]
1- Postgraduate Student ,Tehran University, Department of Civil Engineering
2- Professor, Tehran University, Department of Civil Engineering
⋮
s.resatalab@ut.ac.ir
attarnjd@ut.ac.ir
⋮

Abstract

Dam interaction with foundation is important subject in analys of concrete gravity dams , so always needed to new methods for improved and examined accuracy than last methods and caused to more recognition of behavior of dams for analysing and designing .

The influence of base-rock characteristics on non-linear seismic response to different earthquake input mechanims including dam-foundation interaction is investigated by using the lagrangian approach in this paper. The elasto-plastic behavior of the dam concrete is idealized. Dam and foundation rock are modeled by using 8-noded isoparametric quadrilateral solid Finite-elements.

In this paper ,two different earthquake input mechanisms are used to consider the effect of base-rock characteristics in the analyses: the standard rigid-base input and the massless-foundation input models . A concrete gravity dam with results of recorded from earthquake is chosen for testing numerical model. The results obtained from non-linear analyses are campared with the results of linear analyses.

Keywords: Dam-foundation interaction ; Concrete gravity dam; Lagrangian approach ; Finite elements; Earthquake input mechanisms

1. INTRODUCTION

Concrete gravity damswill continue to keep their importance in satisfying the ever increasing demand for power, irrigation and drinking water, the protection of man.

There are several factors affecting the dynamic response of concrete gravity dams to earthquake ground motions. Some of them are the interaction of the dam with the foundation rock and water in reservoir. The importance of thefoundation interaction on the behaviour of concrete damsunder earthquake ground motions has long been recognized[1,2].

In the literature, tow different earthquakeinput mechanisms are used to consider the effectof the local soil conditions on the earthquakeresponse of dam–foundation interaction systems: thestandard rigid-base input model, the massless-foundation inputmodel.In the standard rigid-base input model (Model 1), theearthquake motion applied to the base of the soil layer byfoundation rock .In the massless-foundation input model (Model 2), theidealized foundation model is assumed to be massless.The absence of mass makes the foundation rock as aspring, in other words only the flexibility of the foundationrock is taken into account. In Model II, the rigid-baserock input motions are transmitted instantaneously throughthe foundation rock to the base of the dam, with out any wave propagation effects[3].However, it has long been recognized that siteeffects can significantly affect the nature of strong ground [4].

The assumption of linear behavior may not be appropriate in the analysis of seismic response of concrete gravity dams. Acceptability of the results obtained from the non-linear analysis of concrete dams is dependent on the approach used in themodeling of dam concrete.In thisregard, theories based on fracture mechanics are commonly applied in most of engineering analysis [5–8]. In addition, theoriesbased on plasticity models are used to investigate non-linear seismic response of concrete dams to earthquake groundmotion [9].

The purpose of the present paper is to investigate theeffect of base-rock characteristics on dynamicresponse of dam–reservoir–foundation interaction systemssubjected to different earthquake input mechanisms by usingthe Lagrangian approach. The elasto-plastic behavior of the dam concrete is idealized using Drucker–Prager yield criterion based on associatedflow rule assumption[10]and campared results obtained from non-linear analyses are with the results of linear analyses.