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# 堤坝非线性地震响应的离散型剪切条模型等价线性化方法

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**摘要** 摘要: 基于一维剪切梁计算模型, 对堤坝非线性地震动力响应提出了改进的等价线性化方法。首先, 考虑土的剪切刚度与阻尼的层状分布, 建立了离散型剪切条计算模型, 通过求解确定了堤坝的自振特性, 基于黏线弹性模型给出了堤坝地震反应封闭形式的解答, 然后, 将所得到的黏线弹性解答与等价线性化方法相结合, 通过反复迭代使每层的模量和阻尼比与其自身的剪应变相协调, 由此确定与堤坝非线性系统相等效的线性体系, 并以所得到的地震响应作为非线性地震响应的近似解; 最后, 通过对算例的数值计算与分析论证了这种以剪切条模型为基础的堤坝非线性地震响应等价线性化方法的合理性。

**关键词** [关键词: 岩土工程](#) [地震响应](#) [剪切条模型](#) [非线性分析](#) [等价线性化方法](#) [黏弹性模型](#)

分类号

## EQUIVALENT LINEARIZATION TECHNIQUE BASED ON

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### Abstract

**Abstract:** As a simplified analytical procedure, the shear-beam or shear-slice model is widely employed for evaluating dynamic response of earth dams or embankments. In order to improve the accuracy or extend the range of this simplified model, many efforts have been made in the past several decades. A modified equivalent linear technique for analysis of seismic response of embankments, which is based on one-dimensional shear-slice model is presented. In the proposed method, the discrete shear-slice model is developed to consider the layered distribution of shear moduli and damping ratios of soils with depth. The differential equations for governing the vibration of embankment are solved mathematically under the assumption that the soils of embankment display visco-linear-elastic behavior; and the closed-form solutions for the natural characteristics and seismic response of the embankment are obtained. The achieved linear solutions are incorporated with equivalent linearization technique for seismic response of embankment or soil strata. A series of trial-and-error iterations are performed to make the moduli and damping ratios of all individual layers be compatible with their strain amplitudes. Then, a linear system which is overall equivalent to nonlinear embankment system is achieved; and the seismic response for this equivalent linearization system can be taken as a good approximation of nonlinear seismic response of embankment. Finally, numerical computations are conducted for a given example and the numerical results are compared with the solutions obtained with finite element method to illustrate the rationality of the proposed method.

**Key words** [Key words: geotechnical engineering](#) [dynamic response](#) [shear-slice model](#) [nonlinear analysis](#) [equivalent linearization technique](#) [viscoelastic model](#)

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