



## 基础类成果

# 土动力学理论创新与土石坝抗震安全评价体系

### 【创新性】

研制了世界上第一台振动三轴仪，创立了我国第一个土动力学实验室，在国内外首先提出了土体振动孔隙水压力产生、消散和扩散的机理和土体液化机理，创立了我国土体液化判别方法。建立了中国水科院真非线性动力本构模型，创立了我国土石坝抗震安全评价和抗震设计思想，奠定了我国土动力学和土工抗震研究的理论基础和领先地位。建立了室内试验和现场试验相结合、原型震害 - 数值模拟 - 物理模拟相结合的土工抗震分析方法和安全评价方法，得到了紫坪铺面板坝 5.12 震害的验证。汶川地震后，围绕高土石坝抗震新需求，首先提出了基于变形、稳定和防渗体及地基安全的高土石坝极限抗震能力分析方法和判别标准。构建了变形分析和稳定分析相结合、整体稳定分析和局部稳定分析相结合的高土石坝抗震安全评价体系。

主要完成人：汪闻韶、常亚屏、李万红、刘小生、赵剑明  
刘启旺、杨玉生、杨正权、李红军  
获奖单位：岩土所

### 【影响力】

1980 年在英国举办的国际学术讨论会做“土液化特性中的几点发现”的大会报告，获得国际学术界和同行的高度评价；Finn 等国际著名学者在会后出版的书籍《Soil Mechanics—Transient and Cyclic Loads》中，特别以一章的篇幅专门介绍汪闻韶院士的研究成果。所提出的“少黏性土液化判别标准”成为国际广泛引用和应用的判别方法。创立的我国土体液化判别方法被水利、水电、土木、建筑等行业规范所采纳，并沿用至今。构建的基于变形、稳定和防渗体及地基安全的高土石坝抗震安全评价原则和方法，被汶川地震后国标制定和行标修编采纳。

## THEORETICAL INNOVATION OF SOIL DYNAMICS AND THE EVALUATION SYSTEM FOR THE SEISMIC SAFETY OF EARTH-ROCK DAMS

### 【Innovation】

The project developed the world's first vibration triaxial apparatus, created the first soil dynamics laboratory in China, and put forward the mechanisms of generation, dissipation and diffusion for pore water pressure under soil vibration as well as the soil liquefaction mechanism at home and abroad, and built the evaluation method for soil liquefaction in China; established IWHR nonlinear dynamic constitutive model, and created the seismic safety evaluation and design thoughts for earth-rockfill dams in China, laying a theoretical foundation and leading status for geotechnical engineering of China; established the seismic analysis and safety evaluation methods for geotechnical engineering in combination

with indoor and field tests as well as prototype earthquake damage - numerical simulation - physical simulation, which were validated by the 5.12 earthquake damage of the Zipingpu concrete faced rockfill dam; initially put forward the analytic method and discrimination standard for the maximum anti-seismic capability of high earth-rock dams based on deformation, stability, anti-seepage body and foundation safety after the Wenchuan Earthquake, in order to tackle the new anti-seismic demand of high earth-rock-fill dams; established the anti-seismic safety evaluation system for high earth-rock dams in combination with deformation and stability analysis as well as overall and local stability analysis.

### 【Influence】

The research group delivered a report entitled "several findings among soil liquefaction characteristics" at an international academic seminar held in the UK in 1980, gaining high praise from the international academic circles and peers; international well-known scholars including Finn specially introduced Academician Wang Wenshao's research achievements in a whole chapter of the book, Soil Mechanics - Transient and Cyclic Loads, which was published after the seminar. The "evaluation standard for less cohesive soil liquefaction" has become an evaluation method for extensive citations

and applications worldwide. The evaluation approach for soil liquefaction in China created by the project has been adopted by the norms of industries such as hydraulic engineering, hydropower, civil engineering and construction, and is still used today. The evaluation principle and method for the anti-seismic safety of high earth-rock-fill dams based on deformation, stability, anti-seepage body and foundation safety were adopted by the formulation of national standards and the revision of industry standards after the 5.12 Wenchuan Earthquake.

Main Contributor : Wang Wenshao, Chang Yaping, Li Wanhong, Liu Xiaosheng, Zhao Jianming  
Liu Qiwan, Yang Yusheng, Yang Zhengquan, Li Hongjun  
Award-winning Unit : Department of Geotechnical Engineering

