技术类成果

高混凝土坝结构安全关键技术研究与实践

【创新性】

提出了基于大坝真实性态的设计新理念以及有限元等效应力、变形体时程动态稳定、高压水劈裂等分析方法及控制标准，解决了传统方法设计 200m 以上特高坝时存在的问题；提出了拱坝合理体形设计方法并开发了配套软件，发明了高混凝土坝抗高压水劈裂的柔性防渗、自反滤防渗结构。发现了多元胶凝粉体的紧密堆积和复合胶凝效应，提出了配制高坝混凝土的新方法，解决了传统方法配制混凝土时高强度与高抗裂、高耐久难以兼顾的难题。提出了大坝混凝土施工智能监控新方法，创立了高混凝土坝安全、优质、高效成套施工技术。开发了混凝土坝真实性态仿真平台，实现了大坝结构的“安全可控、性态可测”。

【影响力】

广泛应用于我国三峡、锦屏一级、小湾、拉西瓦、大岗山、向家坝、龙滩、藏木、景洪、丹江口等国内 91 座高混凝土坝和埃塞俄比亚、缅甸、柬埔寨、老挝等国外 7 座高坝工程，为上述世界级工程的成功建设、实现拱坝从 272m（英古里）到 305m（锦屏一级）坝高的跨越做出了重要贡献，为南水北调中线水源工程丹江口大坝的加高提供了重要技术支撑，并为未来乌东德、白鹤滩等一批 300m 级高坝工程建设提供了坚实的技术基础。成果鉴定和国际大坝委员会评价认为达到国际领先水平，获得 2016 年度国家科技进步二等奖。项目成果列入标准 13 项，获专利 30 项（发明 15 项）、软件著作权 11 项，出版专著 6 部，发表论文 121 篇。

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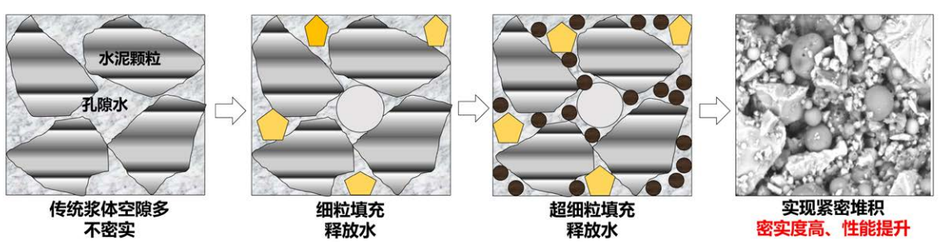
多元胶凝粉体紧密堆积效应原理图



RESEARCH AND PRACTICE OF KEY TECHNOLOGIES FOR STRUCTURAL SAFETY OF HIGH CONCRETE DAMS

【Innovation】

The Center has put forward new design concepts based on the actual behavior of dams and the analytic methods and control standards for the finite element equivalent stress, dynamic stability of the deformable bodies in the time course and high pressure water splitting, and solved problems faced with the design of ultra-high dams of over 200 meters through conventional methods; proposed the reasonable shape design method for arch dams and developed supporting software, and invented soft seepage prevention and self-filtration structures of high concrete dams resistant to high pressure water spitting; discovered close packing of diverse cementious powders and the composite cementious effect, put forward new methods for the preparation of high dam concrete, and addressed the issues faced with the preparation of concrete with traditional methods where high intensity, cracking resistance and durability resistance are difficult to be taken into full account; put forward new methods for the intelligent monitoring of dam concrete construction, and developed safe, superior and high-efficient packaged construction technologies for high concrete dams; developed an actual behavior simulation platform for concrete dams, and achieved the safety, controllability and behavior measurement of the dam structure.

【Influence】

The research outcomes have been widely applied in 91 high concrete dams in China, such as Three Gorges, Jinping First Stage, Xiaowan, Laxiwa, Dagangshan, Xiajiaba, Longtan, Zangmu, Jingtao and Danjiangkou, and seven high dam projects in countries like Ethiopia, Myanmar, Cambodia and Laos, which have made great contributions to the successful construction of the above world-class projects as well as to the transformation of the height of arch dams from 272m (Yingguli) to 305m (Jinping First Stage), provided important technical support for the heightening of the Danjiakou Dam, a water resources project in the middle route of South-to-North Water Transfer Project, and given a solid technical basis for the construction of a batch of 300m-level high dam projects, including Wudongde and Baihetan, in the future. The achievements have reached the international advanced level through identification and evaluation of the International Commission on Large Dams, and won the second prize of the National Science and Technology Progress Award in 2016. The project results were listed into 13 standards and 30 patents (15 inventions) as well as 11 software copyrights. Besides, six monographs were published, and 121 papers were published.

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Award-winning Unit : Research Center for Sustainable Hydropower/Department of Structures and Materials、IWHR-KHL、Secretariat of Chinese National Committee on Large Dams