基础类成果

泄水建筑物流激振动理论与应用

【创新性】

我院自 1958 年起开展了泄水建筑物流激振动理论与研究。通过水弹性模拟试验和原型观测对比研究，首次系统研究了紊流脉动压力荷载。率先成功研制出可模拟钢结构的水弹性模拟材料，实现了振动变态模拟到全水弹性模拟的转变，引领了钢结构流固耦合振动模拟的发展。首次对水流的附加质量、流速引起的附加刚度、附加阻尼对耦合系统的影响进行了系统研究，发展了闸门动力特性理论及动力响应的有限元分析方法。在国内率先提出了以水为介质的水弹性相似准则，制定了流激振动模拟的行业标准，推动了流激振动相关学科的快速发展。

【影响力】

中国水科院早在五十年代末就开展了闸门水力学和流激振动原型观测及模型试验研究，是国内率先开展相关研究的单位之一，推动了流激振动相关领域学科的建设发展。成功地解决了三义寨、刘家峡、五强溪、大化、安康、三峡、小浪底、二滩、溪洛渡、向家坝、白鹤滩等国内外六十多项重大工程闸门流激振动问题。相关研究成果和论文获得 1978 年全国科技大会表彰，获得国家科技进步二等奖 1 项，省部级奖 7 项，IAHR 杰出论文奖及水利学会优秀论文奖等多项奖励。

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受奖单位：水力学所

THE THEORY OF FLOW-INDUCED VIBRATION OF DISCHARGE STRUCTURES AND ITS APPLICATION

【Innovation】

IWHR has conducted the research of the flow-induced vibration of discharge structures since 1958. Through the comparative study of hydro-elastic simulation test and prototype observation, IWHR researched the turbulent fluctuation pressure loads systematically for the first time. It was the first to successfully develop the hydro-elastic simulation materials which could simulate the steel structure, realizing the shift from the abnormal vibration simulation to the full hydro-elastic simulation, and leading the development of fluid-solid coupling vibration simulation of the steel structure. IWHR conducted the systematic research on the additional quality, the additional rigidity and the additional dampening that induced by water flow, and studied their influences on the coupling system. The institute developed the theory of dynamic characteristics for gates as well as the finite element analysis method for dynamic response. It is the first in China to put forward the hydro-elastic similarity criterion with water as the medium, formulate the industry standard for the flow-induced vibration simulation, and drive the rapid development of flow-induced vibration related disciplines.

【Influence】

Back in the late 1950s, IWHR conducted the floodgate hydraulics and flow-induced vibration prototype observation and model testing study, making it among the first batch of institutions in China that carried out related research, and promoting the construction and development of flow-induced vibration related disciplines. The project has successfully solved the flow-induced vibration issue on floodgates of more than 60 key projects, such as Sanyizhai, Liujiaxia, Wuqiangxi, Dahua, Ankang, Three Gorges, Xiaolangdi, Ertan, Xiluodu, Xiangjiaba, Baihetan, etc. Relevant research achievements and papers were honored by the National Science Conference in 1978, and won one second prize of the National Science and Technology Progress Award, seven provincial and ministerial awards, IAHR's outstanding paper award and the excellent paper award by the Chinese Hydraulic Engineering Society (CHES).

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