技术类成果

大体积混凝土防裂智能温控关键技术

【创新性】

提出智能温度控制的模式架构，实现温控全要素、全过程的透彻感知、全互联、实时分析与智能控制。构建了理想温度过程、混凝土温度预测、通水流量预测等智能化温控的九个关键模型，实现了各类温控参数及温度应力的实时计算。研发了十项适应恶劣施工环境的智能化温控成套装备，包含便携式温度采集设备、水气二相流喷雾装备、高精度数字测控单元、换向装置等；开发了大体积混凝土防裂智能温控成套软件，实现了温控信息的自动获取、高效管理、开裂风险的预警报警及温控施工的决策干预。

【影响力】

研究团队历时 16 年，针对“无坝不裂”世界级难题，开拓研发了混凝土坝智能温控成套模型、软件系统与硬件装备，实现了混凝土坝拌合、仓面、通水、保温的全要素、全环节、全过程精细化智能调控。目前已成功应用于锦屏一级、鲁地拉、藏木、丰满重建、黄登、大华桥、大藤峡、杨芳沟、大古等国内十余项重大水电工程，为混凝土坝的建设提供了有力技术支撑，防裂效益和经济效益显著。本技术实现了混凝土坝温度控制由传统手工模式至先进智能模式质的转变，全面提升了混凝土坝的温控防裂水平，实现了行业引领。发表学术论文 100 余篇，申请国家发明专利 60 余项，获批水利部先进实用推广证书 2 项，注册国家商标 1 项，省部级特等奖 1 项。

主要完成人：张国新、刘　毅、李松辉、张　磊、刘有志、
王振红、朱振泱、杨　萍、张　龑、邱永荣

受奖单位：水电中心 / 结构材料所

KEY INTELLIGENT TEMPERATURE CONTROL TECHNOLOGIES FOR CRACKING PREVENTION OF BULK CONCRETE

【Innovation】

It proposed the intelligent temperature control mode architecture, and achieved the depth sensing and perceiving comprehensive interconnection,real-time analysis and intelligent control of all factors of temperature control in the whole processof engineering construction; built nine key models for intelligent temperature control, such as ideal temperature process, concrete temperature forecast and water flow forecast, and realized the real-time calculation of various types of temperature control parameters and temperature stress; developed ten intelligent temperature control outfits adaptive to the harsh construction environment, including portable temperature acquisition equipment, water-air two-phase flow spraying equipment, high-precision digital measurement and control unit, reversing device, etc.; developed intelligent temperature control software kits for cracking prevention of bulk concrete, and achieved automatic acquisition and high-efficient management of temperature control information, advanced warning of cracking risks and decision intervention in temperature control construction.

【Influence】

Targeting the dam cracking problem worldwide, the research group has developed intelligent temperature control model kits, software systems and hardware equipment for concrete dams within 16 years, so as to achieve refined intelligent regulation of all factors-mixing, placing area, water cooling and heat preservation - of concrete dams in the full links and whole process. Currently, the technology has been successfully applied in a dozen key hydropower projects in China, such as Jinping First Stage, Ludila, Zangmu, Zangmu, reconstruction of the Fengman dam, Huangdeng, Dahuaqiao, Datengxia, Yangfanggou, Daguo, providing vigorous technical support for the construction of concrete dams, and achieving outstanding anti-cracking and social benefits. The technology has enabled temperature control of concrete dams to achieve the quantitative shift from the traditional manual mode to the advanced intelligent mode, which has comprehensively improved the temperature control anti-cracking level of concrete dams and taken lead in the industry. The research group has issued nearly 100 academic papers, applied for 60 national invention patents, and received two advanced practical promotion certificates from the Ministry of Water Resources as well as one special prize at provincial and ministerial levels.

Main Contributor : Zhang Guoxin, Liu Yi, Li Songhui, Zhang Lei, iu Youzhi, Wang Zhenhong
Zhu Zhenyang,Yang Ping, Zhang Yan, Qiu Yongrong

Award-winning Unit : Research Center for Sustainable Hydropower/Department of Structures and Materials