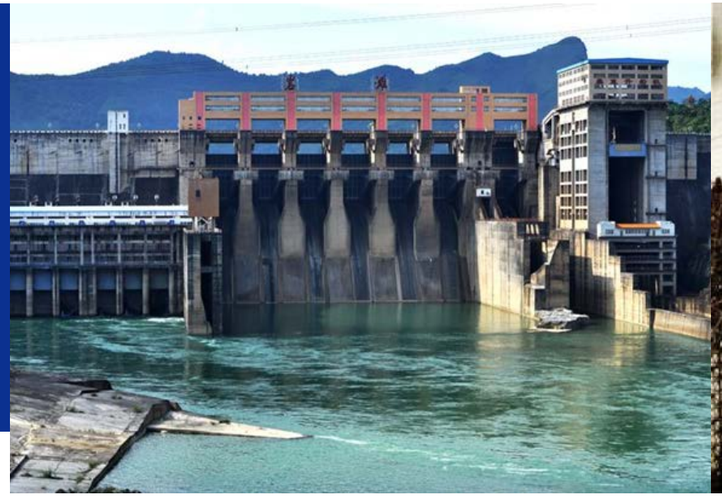
技术类成果

宽尾墩、窄缝新型消能工



【创新性】

20世纪80年代，我院首创了“宽尾墩”、发展了“窄缝”等新型消能工。这种收缩射流消能技术是我国自主创新的适用于高坝、大流量的泄洪消能新技术。在国内首次对宽尾墩消能技术进行了深入的理论研究和系统试验，掌握了消能机理、水力特性和设计方法；对宽尾墩体型参数进行了系统研究，提出了闸孔收缩比、收缩率、收缩角等参数的优化范围；首次提出了宽尾墩－消力池、宽尾墩－底孔－消力池、宽尾墩－高坝台阶式坝面消能和底流消能相结合等多种形式的联合消能创新技术，提高了消能效率，缩短了消力池长度。在国内首次对窄缝挑射水流的水力特性进行了系统的理论研究。提出了窄缝挑坎水舌的上下缘挑距、水深、冲刷坑深度等估算公式；解决了急流冲击波、侧墙脉动压力及流激振动等技术难题。

【影响力】

30余年来，宽尾墩发展出了基本型、X型、Y型等多种体型，与各种消能工结合运用，形成了多种独具特色的消能方式。宽尾墩、窄缝等消能技术已成为我国的主流消能技术之一，被各大设计和科研单位广泛采用，其主要理论和设计方法已写入高校教科书，编入《溢洪道设计规范》，在行业中占有重要地位。该技术在全国近百项水电工程中得到直接应用，收缩式消能的理念更为其他消能工的设计开拓了思路，提供了宝贵的经验，为学科发展和行业进步做出了巨大贡献。研究成果获国家科技进步二等奖1项，国家发明三等奖1项，省部级奖3项。

主要完成人：林秉南、李桂芬、谢省宗、龚振赢、高季章、刘树坤、李世琴、王念慎、李铁洁

受奖单位：水力学所

NEW ENERGY DISSIPATORS OF FLARING GATE PIER AND NARROW SLIT

【Innovation】

In the 1980s, our Academy initiatively created new energy dissipation technologies, such as flaring gate pier and narrow slit. The energy dissipation technology for contraction and jet flow enables the stilling pool to shape stable ternary hydraulic jump , and significantly improves the energy dissipation efficiency per unit volume, making it a new energy dissipation technology applicable to high dams and flood discharge of large flow with independent innovation in China. The Academy conducted in-depth theoretical research and systematic experiments of flaring gate pier, a new energy dissipation tool, for the first time in China, and grasped the energy dissipation mechanism, hydraulic characteristics and design method; carried out systematic research of the configuration parameters of flaring gate pier, and put forward the range of optimization for parameters like the gate orifice contraction ratio and angle; initially put forward new joint energy dissipation technologies in forms of flaring gate pier-stilling pool, flaring gate pier-bottom orifice-stilling pool, and flaring gate pier-high dams in combination with energy dissipation by stepped dam face and bottom flow, which has improved the energy dissipation efficiency and reduced the length of the stilling pool. It conducted systematic theoretical research of hydraulic characteristics for the deflecting flow of narrow slit for the first time in China; put forward the estimation formulas for the trajectory distance between the upper and lower edges of the slit-type flip bucket tongue, water depth and scouring pit depth; solved technical problems such as rapid flow shock wave, side wall fluctuating pressure and flow-induced vibration.

【Influence】

Our Academy has developed various sizes of flaring gate pier, such as basic, X and Y types over the past three decades, which have formed various energy dissipation modes with unique features in combination with all kinds of energy dissipation structures. The energy dissipation technology such as flaring gate pier and narrow slit has become one of the dominant energy dissipation technologies in China, and has been widely adopted by numerous design and scientific research institutions. Major theories and design methods proposed by our Academy have been written in the textbooks of Universities, and compiled into the Code for Design of Spillways, holding an important position in the industry. This technology has been directly applied in nearly one hundred hydropower projects nationwide, and the contractive energy dissipation concept has even opened up new thoughts for the design of other energy dissipation tools, offered precious experience, and made great contributions to the disciplinary development and industrial development. Relevant research achievements won a second prize of the National Science and Technology Progress Award, a second prize and a third prize of the National Award for Technological Invention, as well as three provincial and ministerial awards.

Main Contributor : Lin Bingnan, Li Guifen, Xie Shengzong, Gong Zhenying, Gao Jizhang Liu Shukun, Li Shiqin, Wang Nianshen, Li Tiejie

Award-winning Unit : Department of Hydraulics