基础类成果

冷却水工程水力热力模拟理论与实践

【创新性】

1958 年，针对我国首座百万千瓦的辽宁清河电厂取排水工程布置设计中出现的中苏争议，我院首用温差水体作为试验介质研究冷却水运动，发现了重要的“温差浮力效应”，利用此效应可有效避免“热水短路”，大幅节约工程投资。1964 年，正式提出冷却池水流运动模型相似理论及模拟试验方法，其关键核心在于提出“综合参数”的概念，解决了水力热力模型试验中严格要求水流运动相似、动力相似和热力相似带来的比尺间矛盾，使得复杂的冷却水运动模拟成为可能，成为大量水力热力模型的设计依据，后来又拓展到风吹效应、冰冻和融冰效应等更加复杂环境条件下的冷却水模拟。该理论已成功用于国内外数百项火核电工程冷却水研究，为电力发展提供了重要的技术支撑。

【影响力】

上世纪五六十年代，我院在国内率先开展了冷却水水力热力研究，是冷却水专业的发源地。七十年代，我院举办了全国性冷却水培训研讨班，为国家培养了一批冷却水方向的专业人才，有力推动了国内电厂水工设计和冷却水工程研究的发展。 1995 年，我院以此理论为基础编制了《冷却水工程水力、热力模型试验规程》(SL160-95)并在全国推广应用，2012 年又对该规程进行了修编。该项理论已经成功用于国内外数百项大型火、核电工程冷却水问题研究，为电厂取排水工程设计提供了重要的科学依据，为电厂安全、经济运行提供了技术保障。有关成果获得国家科技进步一等奖 1 项、二等奖 1 项。

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受奖单位：水力学所

HYDRAULIC AND THERMAL SIMULATION THEORY OF COOLING WATER ENGINEERING AND PRACTICE

【Innovation】

In 1958, a dispute arose between China and the Soviet Union over the layout and design of water intake and outlet projects of the Qinghe power plant in Liaoning province, the first million-kilowatt-class one in China. With regard to this dispute, our Institute used water bodies with temperature differences as the test medium for the first time to study the movement of cooling water, and discovered the important buoyancy effect resulting from temperature differences, which can effectively avoid hot water shortage, and significantly save engineering investment. In 1964, the project officially put forward the similarity theory and simulation method for the cooling pool water flow model, which proposed the concept of “comprehensive parameters”. It solved the inter-scale conflict arising from the strict requirements of similarities in water flow motion, dynamics and thermodynamics in hydro-thermal model experiments, and made the complicated cooling water movement simulation possible, which has provided a basis for the design of a large number of hydro-thermal models subsequently, and expanded to the cooling water simulation under more complicated environment conditions, such as the wind-blowing, frozen and ice-melting effects. The theory was successfully applied in the research of cooling water for a few hundred thermal and nuclear power projects in China, providing key technical support for the development of electric power.

【Influence】

In the 1950s to 1960s, IWHR conducted the cooling water study for the first time, and it is the place where cooling water study originated in China.In the 1970s, our Institute organized cooling water training classes across the country, which had fostered a batch of professional talents relating to cooling water for the country, and vigorously promoted the hydraulic structure design of power plants and the research of cooling water engineering. Based on this theory, our Institute compiled the Regulation for Hydraulic and Thermal Model in Cooling Water Projects (SL160-95) and popularized and applied it nationwide in 1995, and revised it in 2012. This theory has been successful used for the research of the cooling water issue in a few hundred large-scale thermal and nuclear power projects at home and abroad, providing an important scientific basis for the design of water intake and outlet projects of power plants as well as technical guarantee for their safe and economical operation. Relevant achievements have won one first prize and one second prize of the National Science and Technology Progress Award.

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