

## 著作类成果

# 异重流与泥沙工程实验与设计

### 【创新性】

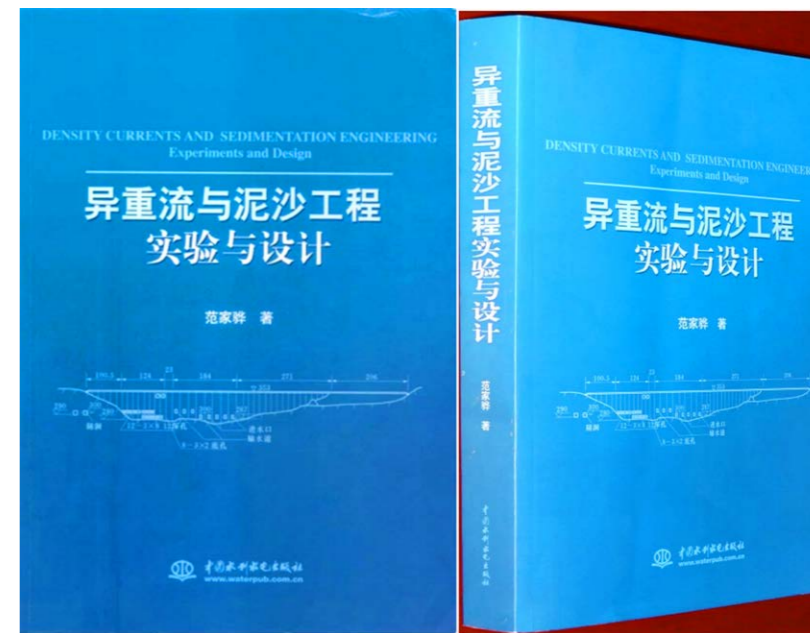
本著作包括异重流水力学、泥沙工程、泥沙沉淀和饱和含沙量水槽实验三部分二十九章，提出了适合泥沙沉淀时分离出清水进入上层清水层的异重流运动方程，可以计算异重流水沙沿纵向的变化。运用二层流理论分析并结合实验、观测资料，提出异重流潜入条件判别数（1959年），2007年又提出了低含沙和高含沙水流潜入点判别数，建立了统一公式。率先发现并区分浑水的急流正掺混（上层清水进入下层异重流），缓流负掺混（盐水中不存在）现象，首次提出包括正负掺混的经验公式。提出孔口排沙的极限吸出高度变量，异重流极限吸出高度无量纲判别数 HL。国内外学者的盐水、泥沙试验结果，亦均符合 HL 数。提出水库壅水淤积形成的滩比降、降低水位进行水库冲沙形成的槽比降计算方法。提出水库异重流排出沙量的近似计算方法，得到国际公认。提出壅水异重流（电厂沉灰池）与非壅水异重流泥沙池的设计方法。用水槽试验获得进入引航道泥沙异重流初速公式，提出浑水异重流船闸引航道沿程淤积的估计方法。对长江河口航道的盐水楔和浑水楔淤积、挖槽回淤进行了全面研究，首次取得潮汐纵向、大风掀沙横向异重流对航道影响等成果。

### 【影响力】

本著作是范家骅教授五十年来泥沙异重流科研的成果之大成。包括：早期实验及资料总结分析的理论成果；在职期间接受委托的工程实验、科研项目的工作成果；退休后不断总结完善的研究成果。本书对异重流的基本理论和水利工程异重流问题进行系统总结和阐述，国内外已出版的异重流专著，尚未有针对讨论浑水异重流和工程泥沙。专著出版后，国内高校、流域管理部门专家学者，对专著给予高度评价，一致认为本专著对水力学及河流力学的学科发展具有巨大贡献。水库异重流运动规律的研究成果在三门峡、刘家峡、小浪底等干支流水库调度实践中都得到应用。我国多沙河流水利枢纽的淤积、排沙规划设计的合理性，已被我国北方河流水利枢纽建设长期运用实践得到证实。

主要完成人：范家骅

获奖单位：泥沙所



## DENSITY CURRENT AND SEDIMENTATION ENGINEERING: EXPERIMENTS AND DESIGN

### 【Innovation】

This book consists of three sections and twenty-nine chapters, covering density current hydraulics, sedimentation engineering problems, experiments on sediment settling and saturated sediment concentration. It presents basic equations of turbid density current with clear water entering upper layer by settling of sediment down to the bottom layer, which can figure out longitudinal change of water and sediment in density currents. Based on two-layer stratified flow theory analysis, as well as experimental and observational data, this book presents the discrimination number for plunging point of a density current (in 1959), and then presents the discrimination number for plunging point of low-sediment and hyper-concentrated flows and established a unified formula in 2007. It takes the lead in discovering and distinguishing the positive mixing in supercritical flow (upper clear water enters lower density current) and negative mixing in subcritical flow (not exist in saline density current) of turbid density current, and presenting the empirical formulas for both positive and negative mixing. It presents the limit suction height of sediment flushing through sluices, and dimensionless discriminant value HL of the limit suction height of sediment flushing by density currents. HL also applies to saline

### 【Influence】

This book gathers Prof. Fan Jiahua's achievements in the study of sediment density current for more than fifty years, including theoretical results of early experiments and data summarization and analysis; achievements of engineering experiments and research programs entrusted in his working life; and research results improved and summarized after his retirement. This book comprehensively summarizes and expounds the basic theories of density currents and density current problems in hydro-projects, and such theory and problems are not discussed in any published books regarding density current at home or abroad. It receives a high appraisal from experts and scholars from universities, research institutes and watershed management departments, who unanimously believe this book makes

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and turbid density current results of domestic and foreign scholars. It presents the methods of calculating the slope of floodplain formed by reservoir backwater deposition, and the channel gradient formed by reservoir drawdown flushing. It presents the approximate calculation method for sediment amount flushed by density currents in reservoirs, which has been internationally recognized. It presents the design method for settling basins for backwater and non-backwater density currents. It obtains, through flume experiments, the formula for initial velocity of a density current in approach channels, and presents a estimate method for sedimentation of turbid density currents along approach channels with a navigation lock. It comprehensively researches saline wedge and turbid wedge sedimentation and re-deposition in dredged channel in the estuary of the Yangtze River, and obtains the impact of navigation channel from tide-induced longitudinal and strong wind-induced transversal density currents and other achievements.

a great contribution to the development of hydraulics and river dynamics. Research findings of density currents in reservoirs have been applied to the regulation of the Sanmenxia Reservoir, Liujiaxia Reservoir, Xiaolangdi Reservoir and many other reservoirs. The rationality of the planning and design for sedimentation and sediment flushing for hydro-projects on the heavy sediment laden rivers in Northern China have been verified by the long-term operation practice of these projects.