

脉冲式浮射流水力特性的实验研究*

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摘要: 目前污水的海洋排放方式可大致分为2种: 恒定或准恒定流量排放; 脉冲式的非恒定排放。对工程中更为常见的脉冲式排放在环境容纳水体中的浮射流运动特性、动量尺度、底边界对浮射流的影响进行实验研究, 此项研究方法及其初步成果为河底射流冲淤排沙研究工作奠定了基础。

关键词: 脉冲式浮射流; 连续性浮射流; 恒定排放; 脉冲式排放

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1 前言

随着沿海地区工业的发展, 污染物外海排放量的增加, 近海受生物、化学污染的程度日趋严重, 如何提高沿海地区水质标准是近年来举世瞩目的海岸工程研究领域的重要课题。Lee 和 Cheung 1991 年在香港举行的环境水力学会议上回顾总结了现有的有关研究成果 (Lee and Cheung, 1991), Brooks 于 1980 年对静止环境水体中污水排放的近区稀释建立了经验公式 (Brooks, 1980), Fischer 等人于 1979 年对平面上垂直于环境水流的浮射流进行了大量研究 (Fischer et al 1979), 他们采用 Novel Approaches 能成功估计浮射流的单个射流迹线和稀释区域 (Lee and Neville-Jones, 1987), Davies 等人对浅水中横向垂直射流的动量尺度和浮力尺度也进行了研究, 取得了不少成果 (Davies et al 1992)。

至目前为止, 所有的研究成果是针对其射流流量为恒定或准恒定的情形, 它们仅适应于恒定的重力排放。然而, 在实践工程中, 更为常见的是, 外海排放的流量是非恒定的, 或称为脉冲式的, 流量的大小随时间是断断续续变化的。这种排放在排放系统内通常设有自动阀门的污水储存室 (Sump) 和管道系统及防盐水侵入装置, 污水先进入储存室, 当水位升至一定程度, 阀门自动打开, 储存室内污水开始通过管道排出, 一旦污水储存室内水位降至一定程度, 阀门又自动关闭, 储存室内又开始储存污水, 至一定水位, 阀门又打开, 开始下一个排污过程。这样, 随着污水储存室的充水和泄水过程, 污水排放流量是一个周期性的脉冲式过程。目前对脉冲式排放特性进行了许多野外调查, 但针对这种情形的实验研究仍尚少 (Dorling, 1989)。本文将对单个脉冲排放在静止

环境水体中的浮射体的运动特性进行实验研究, 分析研究恒定排放和脉冲式排放的周围环境水体的水力特性有何差异。

2 实验装置及方法

如图 1 和图 2 所示, 采用了 2 套不同的供水系统。在图 1 中, 采用了 3 个小水池, 每个池中盛有红色淡水。上方的 2 个水池连接在一起, 高度可以调整, 以便产生不同的射流水头。射流的持续时间和间断时间, 通过 1 个时间控制器控制, 时间控制器的持续时间和间断时间可以调整, 以得到多组实验数据。

图 2 所示装置与图 1 不同的是, 只使用了 1 个水池和 1 个三通的电动阀门, 射流的水头通过调节水泵的电压来实现。这种装置在射流过程中水头有所减小, 但也许与脉冲式污水外海排放的实际情况更为接近。

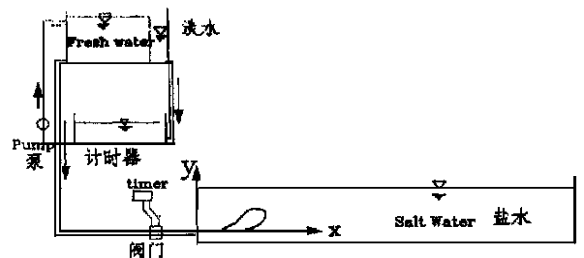


图 1 恒定水头时射流实验装置图

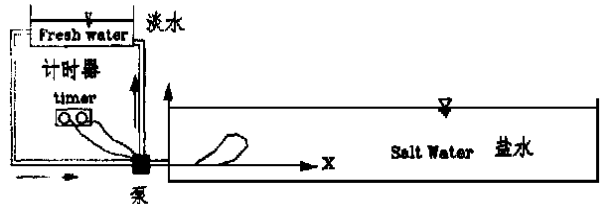


图 2 使用水泵时射流实验装置图

实验所采用的玻璃水槽尺寸为 200 cm × 40 cm × 45 cm, 槽内充满预先配好的密度盐水 (密度 ρ , 大于 $1\ 000\ \text{kg}/\text{m}^3$)。射流孔的位置离水槽底 3.0 cm,

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$$F_r = \frac{U_o(l - e^{-T})}{\sqrt{\frac{\rho_s - \rho}{\rho} g h_N}} < 0.45 \frac{h_N}{D} \quad (4)$$

式中 F_r 表示底部边界对射流的影响程度, 当 $F_r = 2.6$ 时; 射流不受边界影响, 当 $F_r = 3.8$ 时, 射流与环境水体的掺混则严重受到底部边界的影响。

7 结论

脉冲式浮射流、连续性浮射流与环境水体的掺混有很大程度上的差别。射流的初始阶段, t 小于射流持续时间时, 脉冲式浮射流与连续性浮射流无差别, 但是, 当 $t > t$ 以后, 由于脉冲浮射流不再有动量的来源, 运动速度明显减慢。随 t 的减小, 运动速度减小的程度增加。

脉冲射流的前峰无量纲位置 x_f/L_m 、 y_{top}/L_m 与脉冲射流持续时间 t 无关。这一特性和连续性射流相同。

底部边界对射流是否有影响主要与射流出口流速、持续时间、浮力加速 $\frac{\rho_s - \rho}{\rho}$ 及射流孔口离底边界的相对高度有关。方程(4)可初步作为射流不受边界影响的判别条件。

此项研究方法及初步成果为河底射流冲淤排沙研究工作奠定了基础。

参考文献

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突然短路时, 其截断电流时间 t_1 与截止电流 I_p 均很小, 对发电机和变压器几乎无冲击。由实验得到的熔断器的截止电流特性曲线又称限流特性曲线, 从此特性曲线可得不同短路状况下不同预期电流所对应的截止电流值。熔断器另一条特性曲线称为 I^2t 特性曲线, 当预期电流增加到一定值时, I^2t 为一不变常数, 若用断路器来开断短路电流, 既使不考虑非周期分量, 其 I^2t 值也要比熔断器大几千甚至上万倍, 可见破坏力大得多。

高能氧化锌非线性电阻的选择原则是, 其残压值应当将熔断器开断时产生的操作过电压限制在 2.5 倍相电压以内, 并保证正常工作时氧化锌电阻不会误击穿, 同时必须有足够的能量吸收对应截止电流衰减到零时系统中的磁场能量, 并保证一定的能量裕度。负荷开关的选择只需考虑额定电压、额定电流, 结构上满足要求。

4 结论

(1) FURN 的开断方式与断路器有本质的区别, 断路器一般需几个周波在短路电流过零时才能

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开断; 而 FURN 则是在短路电流第一个半波未升起之前强制性的切断短路电流。

(2) 熔断器的快速性和限流性由物理特性所决定, 不存在机械拒动, 可靠性高。熔断器限流性使得主机、主变压器及断路器不再受峰值电流冲击, 延长了使用寿命。熔断器快速性使 I^2t 很小, 可确保厂用变压器不爆炸且母排连接无须考虑动热稳定问题。

(3) 负荷开关只用于开断额定电流和一般过载电流, 大大减轻了负荷开关的负担, 延长了使用寿命和检修周期。熔断器的撞击器可避免缺相运行, 其动作和备用电源联动, 主机可以不停机。

(4) 高能氧化锌电阻限制了操作过电压, 保护了设备的绝缘安全。

(5) 该装置结构简单、体积小、造价低。

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ABSTRACT

The Neural Network Model for Reservoir Operation

FU Shipeng ZHAO Wen-qian MA Guang-wen

(State Key Hydraulic Laboratory of High Velocity Flow of Sichuan University, Chengdu, Sichuan 610065)

Abstract: Because there are much nonlinear relationship in reservoir operation, good results are hard to gained by using traditional linear relationship. Therefore, a neural network model for long tem reservoir operation is established by BP algorithm. It is more practical and superior.

Key words: reservoir operation; neural network; BP algorithm

Application of Artificial Neural Network Model with Nonlinear Time Series in Hydrologic Forecast

WANG Wen-sheng DENG Jing LIU Guo-dong

(Sichuan University, Chengdu, Sichuan, 610065, China)

Abstract: At first, the artificial neural network(ANN) models with nonlinear time series are established, then time series for single variable and multiple variables are studied with the models. The performance of the ANNs is compared with that of the auto-regressive models. The results have showed that the ANNs are effective in hydrologic forecast.

Key words: the artificial neural network models with nonlinear time series; auto-regressive model; single variable; multiple variables; daily discharge forecasting

Application of Percolation Theory in the Water and Soil Conservation for Slope

WANG Xie-kang AO Ru-zhuang FANG Duo

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Abstract: The slope erosion is the original zone of water and soil loss and water and soil on slope must be treated quickly. because rainfall infiltration on slope, afflux and sediment transport is a percolating process, water and soil conservation for cultivated and non-cultivated land on slope is carried out by the percolation theory. Comparing percolation thresholds among the different tow-dimensional percolation models, theoretically, water and soil loss is effectively controlled on slope with honeycomb shape and by hydraulic and biological engineering, which is a new method for water and soil conservation.

Key words: slope erosion; water and soil loss; percolation theory; biological engineering

Study on Engineering Geological Problems at Tanzitai Reservoir in Fengdu County of Chongqing

DENG Rong-gui FU Xiaom in

(Civil Engineering Department of Chengdu Technical Institute, Chengdu, Sichuan, 610059, China)

Abstract: Based on numerous data obtained from field investigations, detail description and in-depth, systematical analysis on engineering geological problems at Tanzitai reservoir in Fengdu County of Chongqing are provided and the results are used as design basis for Tanzitai reservoir.

Key words: reservoir analysis; stability of rock mass; reservoir slope

Nonlinear Properties of Furrow Profiles of Debris Flow in Bailong River Basin

WANG Xie-kang AO Ru-zhuang FANG Duo

(State Key Hydraulic Laboratory of High Velocity Flow of Sichuan University, Chengdu, Sichuan, 610065, China)

Abstract: Debris flow is a nonlinear dynamic process, so the furrows of debris flow have nonlinear properties. Based on analysis of dynamic factors of debris flow growth, accumulative distribution of furrows of debris flow in function with its dynamic factors is studied by fractal theory. The results are satisfactory and benefit for study on debris flow in the Bailong River Basin and Jialingjiang River Basin.

Key words: debris flow; nonlinear; fractal theory

Experimental study on the Hydraulics Characteristics of Intermittent Disposed Buoyant Flows

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Abstract: There are two ways discharge of sewage water into ocean. In addition to the conventional way, the other is intermittent discharge, which is widely used, in recent decades. The hydraulic characteristics of intermittent disposed buoyant flows were preliminary experimentally studied and the differences of the hydraulic characteristics between intermittent discharge and steady discharge were compared in this paper.

Key words: buoyant flows; hydraulic characteristics; intermittent discharge; steady discharge

Several Problems Being Worth Notice in Management of Project with Foreign Funds

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Abstract: In the management of projects with foreign funds, some aspects are worth discussing and improving. Then, the construction market of China will be perfect day by day and transform into international practice smoothly. Experiences and lessons gained from practice in management of project with foreign funds in Ertan Project are presented for reference to similar projects.

Key words: project with foreign funds; problem; relationship; exchange rate; escalation; subcontract; division into lots; supply; claim indemnity