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| 中文题名 | 毛家河水电站库区泥沙冲淤数学模型研究 |
| 英文题名 | Study of sediment deposition in Maojiahe Reservoir |
| 中文关键词 | 毛家河水库, 数学模型, 泥沙淤积, 模拟分析 |
| 英文关键词 | Maojiahe River, mathematical model, simulation and analysis, erosion and deposition |
| 中文文摘 | <p>随着我国水电事业的不断发展, 人们对于水库泥沙淤积危害的认识越来越深入。泥沙淤积对于水电站库区的影响是多方面的, 泥沙淤积会造成水库的库容损失, 包括水库的兴利库容和防洪库容, 影响水库效益的发挥, 削弱原水库的设计蓄洪能力, 带来了防洪方面的风险。同时, 水库中泥沙发生淤积通常也伴随着水体中营养物的沉积, 加上水动力的改变, 容易造成水库富营养化。泥沙淤积所带来的这些多方面的问题都需要在水库规划期间进行较为充分的论证, 并对泥沙淤积所造成的后果有一定的估计和考虑, 给设计和运行方案提供技术支持。贵州省毛家河水电站拟建坝址位于北盘江上游支流清水河上, 是一座以发电为主的水电枢纽。本文基于《SUSBED-2》数学模型对毛家河水电站库区泥沙冲淤进行了模拟计算。通过数学模型中相关参数的比较选取, 针对毛家河水库建成后河段的水力特征改变, 模拟了库区河段泥沙淤积随时间变化的动态过程, 预测了水库运行多年以后的泥沙淤积规律。论文首先在水动力方面模拟了在天然情况和坝前运行水位为 1300m 条件下, 不同洪水的水面线变化情况。根据计算结果, 坝前约 2km 长河段蓄水位为主要影响因素, 保持坝前水位; 在距坝址 2km~8km 处, 水库蓄水位和洪水共同作用, 此河段水位不同洪水水位抬升程度不一, 而距大坝约 8km 处, 水库蓄水位对其影响进一步减弱, 洪水位是影响水位的主要因素, 建库前后同频率洪水水位变化不大。水库成库后水位抬升, 水动力减弱, 水流流速随着水深的增加而减小, 泥沙沉降, 水库发生淤积。同时, 随着水库运行时间的增加, 淤积量增加、同一断面过水面积逐年减小, 从而导致流速随水库运行时间的增加而增加。当河道的挟沙能力与河道泥沙浓度含量一致时, 水库淤积平衡。模型模拟结果较好的反映了这一变化过程, 水库运行 5 年后, 淤积较为明显, 在距坝址 1km 的地方, 深泓处淤积厚度大于 20m, 以后逐年递减, 当水库运行 10 年后, 淤积厚度变化不明显, 达到冲淤平衡。根据这些模拟结果, 论文进一步针对上游水库的不同泥沙调度规律进行情景分析, 计算了毛家河电站的水库调沙方式与上游万口子电站建设与否及出库泥沙量对水库淤积的影响, 从而为水库的工程设计建设和运行管理提供了有力的支撑。</p> |
| 外文文摘 | <p>With the continuous development of water conservancy in China, importance of hazards for the reservoir sedimentation is more deeply recognized in the planning stage. Impact of the reservoir sedimentation for the hydropower station involves many aspects. It results in the loss of storage capacity of reservoir, including the loss of the utilizable capacity and flood control capacity, decreasing the benefit of reservoir, weakening the flood storage capacity of the reservoir of the original design and bringing flood risk. Meanwhile, the reservoir sediment deposition occurs in usually accompanied by the deposition of nutrients in water body, considering the hydrodynamic variations, the reservoir is likely to cause eutrophication. All problems in many aspects brought by the sediment deposition shall be investigated sufficiently in the planning stage of reservoir so as to have an estimation and consideration of the consequences of sediment deposition and provide technical support for the design and operation programs. Maojiahe hydropower station is located in the Qingshuihe River which is one of the tributaries upstream of the Beipanjiang River crossing the boundary of Guizhou province, which is mainly for power generation. This thesis is based on the SUSBED-2 mathematical program to calculate sediment deposition and erosion of the reservoir belonging to the Maojiahe River. Aim to the change of hydraulic characteristics of the river after the Maojiahe reservoir operation, the selection and comparison of the parameters of the mathematical model shall be carried out to simulate dynamic process of sedimentation varied by the time for the reservoir and predict the results due to the sedimentation with the operation of reservoir in many years. Firstly, this thesis covers the simulation of water surface curve variation affected by the flood conditions corresponding to the operating water level in front of the dam. Bas</p> |

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| | <p>ed on the results of the calculations, the river stretch along with the distance of approximately 2 km from the dam is mainly affected, the water surface curve maintains the water level with front of the dam. The water levels at the places with the distance of 2km to 8km from the dam site are raised to the different levels by the various flood levels caused by the combined action of storage water level of reservoir and flood. The water levels at the places with the distance of approximately 8km are less affected by the storage water level of reservoir, but to be affected mainly by the flood level. The flood water levels of the same frequency change little before and after the construction of reservoir. After the reservoir operation, the hydrodynamic condition changes, the velocity of water flow decreases as the water depth increases. The sedimentation of reservoir occurs in. Meanwhile, with the reservoir running, the amount of sedimentation increases accordingly, and the discharge area of the cross section of river diminishes year by year, which causes the velocity of water flow increases. When the sediment-carrying capacity of the river cross section is in accordance with the sediment concentration, it reaches the balance of sediment deposition and erosion. The results of the mathematical model better reflects the process. After 5 years of operation of reservoir, the sedimentation is obviously shown that thickness of sedimentation for the channel line is larger than 20 m at the place with the distance of 1km from the dam site and decreases year by year. And after 10 years of operation of reservoir, the variation of thickness of sedimentation is unobvious and the balance of sediment deposition and erosion is achieved. According to the results of the simulation, the case study is further performed in compliance with the various control rules of sediment for the upstream reservoir, computing the method of sediment management of reservoir and whether the construction of upstream Wanjiakouzi hydropower station shall be performed or not and the impact made by the amount of sedimentation to the reservoir, in order to give strong support for the engineering and construction and operation management of the Maojiahe reservoir.</p> |
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