

## DAMVSIS VISUAL-TECHNIQUES USED IN CONCRETE DAM CONSTRUCTION PROCESSES SIMULATION

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**Abstract:** Dam construction system simulation has proved to do great help to the decision making during the period of system design and construction process, however, the two key issues like the model validity and its simulation result offering, still not be well solved, which will limit the decision makers or users to understand the simulation results, and affect the simulation technology being widespread used in the field. Multi-techniques of visualization, like 2D or 3D, static or dynamic, can efficiently help the system developer and the users to understand the comprehensive and complex model of construction process, and facilitate the detection of logic errors in the simulation models. Meanwhile, they can help to quickly master the data information coming from the model operation. Concrete dam integration visualization simulation system (DamVSIS) is an effective software system developed by authors, which can be used to the Arch Dam or Gravity Dam construction simulation with the pouring machine by cable-cranes, and now we are extending its functions for the various pouring machines. The simulation system can be easy operated by the users for its good interface with visual-operation, and the 2D graph can dynamicly show the system operation process, and other diversity visual-techniques help to depict the results from multi-points of view, like the table, chart. 3D simulation with real environment further helps the decision maker to understand the system quickly and easily according to any simulation parameters.

This paper gives a detailed introduction to the DamVSIS system of its modeling process and of its use in a concrete hydraulic project in China. First part of the paper deal with the mechanism of the concrete dam construction simulation, mainly describes the process of concrete dam construction with cable-cranes, further analyzes the process of modeling based on the system of construction. DamVSIS is consisted of two parts: one is calculating system; the other is GIS-based animation system.

The first system is the core of DamVSIS used in the simulation of concrete dam construction that realizes the visual interface, model running visualization and results visualization. Visual interface provides a platform for convenient operation and guarantees the proficiency of parameters. Model running visualization can express vividly the system operation process and the spatial logic of block pouring. Results visualization adopts diagrams and tables to display the results of simulation calculation, providing the needed information for the users to help them judge the validity of the results.

GIS-based animation system is used for the 3D expression of the block pouring results, which is based on the genuine geographical situation. The fulfillment of this system depends first on the digital modeling, then using the results of calculating system to complete its 3D expression. This system supplies the function of information inquiry as

well.

The integration of calculating system and GIS-based animation system is named DamVSIS. DamVSIS can be applied to the simulation calculation of concrete dam construction with cable-crane and 3D expression of simulation results.

The DamVSIS software had been successfully used in many actual hydroelectric projects in China. Its 2D and 3D dynamic Visual techniques play a critical role in the model evaluation and its information expression. Meanwhile, the different visual techniques can be used to various system requirements, such as the system interface, its model running process and its result depiction. From the DamVSIS software utility on the concrete dam construction simulation, it can be seen that visual-techniques not only can be used for the information expression effectively, but also can do great help to system modeling. Since to a complex system simulation, one single simulation language generally cannot satisfy its multi-requirements, especially the information visualization. Hence the system integration from many simulation environments, like the DamVSIS, has been the trend of system simulation nowadays or in future.

*Keywords:* Concrete dam integration visualization simulation system (DamVSIS); Simulation calculating system; GIS-based animation system; Concrete dam construction with cable-crane