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Analysis Model for Deformation and Seepage of Landslide Dam Based on Random Field Simulation

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The formation process of the landslide lake is influenced by the valley shape, flow conditions and landslide characteristic parameters, which leads to greater uncertainty in the material structure, shape and size of the dam body, thus increasing the difficulty of deformation and seepage analysis of the landslide dam. The time-space variability and uncertainty of material parameters of dam body are not well taken into account in the analysis and calculation of structural deformation and seepage of dam body by conventional model. Therefore, the response of dam structure calculated and analyzed according to the parameters of zonal homogeneous material will inevitably deviate from the actual situation. In this paper, the simulation method of random field of material parameters of a dam body was constructed. Taking a landslide dam in China as an example, the sensitivity analysis of dam body parameters was carried out by using orthogonal test design and finite element numerical calculation method. The parameters of Duncan-Chang E-B model and deformation rheological model, which need to be simulated by random field, and the permeability coefficient of dam body materials were determined. Combined with the improved recursive space method and the measured data of the project, the vertical and along-river correlation distances of the dam were calculated. Finally, the random field of material parameters of dam body was established by using part average subdivision method to discretize the random field. Based on the random field of dam material parameters, three-dimensional deformation and seepage finite element models considering rheology were established respectively. And based on the chaotic phase space reconstruction technology, the deformation and seepage warning values of the landslide dam were worked out. The results showed that the time-space variability and uncertainty of landslide dam material parameters were taken into account in the finite element calculation of dam deformation and seepage, which would cause a certain degree of discretization of structural response. Without considering the spatio-temporal variability and uncertainty of dam material parameters, the calculated results would have a high probability of underestimating the structural response of the dam. Therefore, considering the spatio-temporal variability and uncertainty of dam material parameters in structural calculation can better simulate the actual deformation and seepage of the dam, and the structural response value is closer to the measured value. The models in this paper also provide more accurate data support for the engineering solution of emergency rescue of landslide dams in barrier lakes.