Monitoring of the suffusion process development using thermal analysis performed with IRFTA model

Analysis of the distributed temperature measurements taken on fibre optic cable installed in the body of earth dams is nowadays the most efficient tool of leakage identification and of seepage processes monitoring. However, it requires application of advanced models describing relations between heat and water transport. The IRFTA (impulse response function thermal analysis) model developed by the Authors is one of these models. The model parameters have physical definition. Application of the IRFTA model to the analyse temperature values measured at existing dams has proved its usability in identifying leakages in the early development phase thereof, while precisely determining the intensity of the filtration process by parametric physical description, and also analysing its time-variability. This paper presents numerical modelling of coupled heat and water transport for selected case of developing suffusion process in a 15 m height homogeneous earth dam, as well as the results of thermal analysis of this process by the IRFTA model. The analysis was performed with regard to different lengths of the suffusion layer, various values of the suffusion layer hydraulic conductivity, and various locations of the temperature sensors in the downstream toe of the dam. The study proved correct the IRFTA model being capable to provide for determination of the changes occurring in the filtration intensity. Yet, definition of the opportunity to apply this model to carrying out direct assessment of the suffusion process will require the further study, and that depends on, inter alia, the location of the suffusion layer, as well as the location of the measuring point.

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