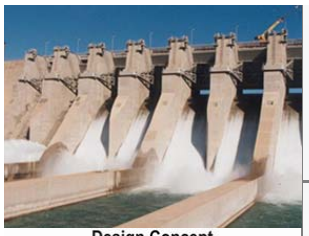

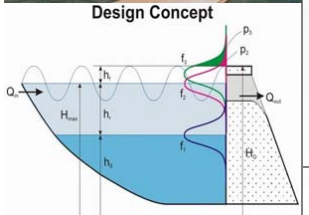

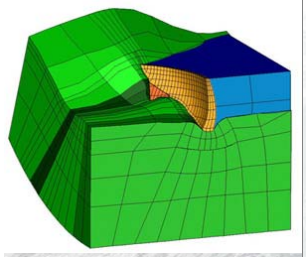

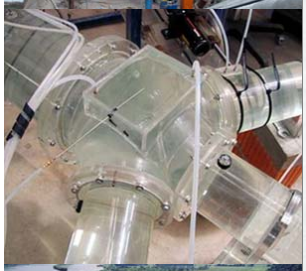

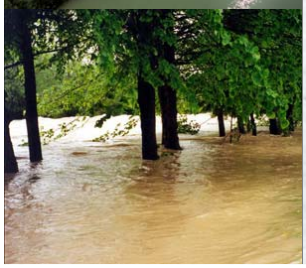

Master Thesis

Large-eddy simulation (LES) of turbulent channel flow over rough beds

Most flows in hydraulic engineering are highly turbulent. The governing equations of fluid flow or Navier-Stokes equations can be solved directly without any turbulence modeling. This type of simulations are computationally intensive and it is not practical for engineering problems. Because of this, several approaches have been developed to reduce the computational effort associated with turbulent flows. One of the most widely used approaches is based on Reynolds-Averaged Navier-Stokes equations (RANS). Although these types of modelling have been successfully applied to engineering flows, they have shown that they fail in predicting particular (complex) flows.

In the past decades, Increasing computational power led to development of a new type of modelling, where large eddies are resolved directly and smaller, isotropic eddies are modelled with subgrid models. This is known as Large-eddy simulation (LES). One of the challenges in LES is modelling flow near rough walls. There are various techniques available to deal with this problem. The first technique is to employ wall-function. The advantage of the method is that roughness can be conveniently accounted for by using equivalent sand grain roughness. Another promising technique is to use porous medium and artificially generated rough elements.

The aim of the study is to implement rough wall-function model to account for the surface roughness in a turbulent channel flow. Furthermore, this wall function will be compared with the porous medium approach. Finally, these methods as well as results from the smooth wall will be compared with experimental results. The computations will be carried out using open-source code OpenFOAM.

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