La turbulencia en los flujos en canales con lechos vegetados. Estudio teórico-experimental con aplicación del "Acoustic doppler Velocimeter" ADV.

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The hydraulic calculations on channel flows are based on drag coefficients associated to every construction material. These coefficients are a simplified model of all the hydrodynamic processes that take place in the interior of the flow, and are fundamentally characterized by a value, the absolute roughness.

The values of the drag coefficients associated to each material are known and described in tables. The flexible roughness is an exception, in this group we find the vegetation present in rivers and channels, these are materials that have an elastic or semi-elastic response to the dynamic loads caused by the water, this causes that the absolute roughness depends on the conditions of the flow. Consequently to evaluate de the state of the flexible roughness it is necessary to the loads that are acting on, so is not enough to work with the macrovariables used in the hydraulics (discharge, water level, mean velocity), is necessary to make an internal description of the flow.

For smooth roughness the description of the flow is simple, defining clearly differentiated zones, with well-known behaviours. For high roughness diverse models of behavior are used to try to describe the present phenomena in the flow. The main problem resides in the fact that increasing the roughness is not possible to simplify the equations of Navier-Stokes since the flow reaches a three-dimensional character.

The dynamics of the fluids on all the scales is known as turbulence, this measures a series of parameters and properties that completely characterize the flow, becomes necessary a union between the simplified coefficients used by the hydraulics and the hydrodynamic behaviors described in the turbulence. In fact this means to unite the calculations at great scales (hydraulic) with the calculations at small scale (turbulence).

At the present time exist instruments as ADV that takes data used in hydraulic (average speeds) and data of turbulent interest (instantaneous speeds). The analysis of the data collected by this instrument concludes that the configurations of the instrument at high sampling frequencies and at small control volumes throw data that are good enough for hydraulic analysis but not for a turbulent one.

As consequence of this result, inside all the data available for their analysis we only use the one valid from the turbulent point of view. Two series of data are analysed, the first one corresponds to a profile taken on a gravel bed, we obtain turbulent parameters as the viscous dissipation of the fluid and hydraulic parameters as the power dissipated by the channel can be obtained, in this case the evaluated values obtained by both methods throw very different values. Another case is the Reynolds stress, a clearly turbulent parameter, that it is resisted with the bottom stress that is a hydraulic value. In this case the results present display enough similarity, and two hypotheses are exposed to justify the small variation between values.

The increase in the computation capacity of the actual computers causes that new investigation lines are opened. In turbulence govern the Navier-Stokes equations, to model them we needed very fine meshes or the use of turbulent models, at the moment desktop computers are able to solve simple cases, this makes possible that in immediate future could be solved models that incorporate geometries associated to roughness, being able to obtain drag coefficients by numerical methods and to test them with the experimental ones used in hydraulic.