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Twice Averaged Over Light Kennel Stream with Slight Comparative Plunging: Review Study

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ABSTRACT

We examine the turbulent structure of the open-channel flow, in which the flow depth is very small (Compared to the hardness height) to form a logarithmic layer but it is large enough to form an outer layer in which the flow is not directly affected by the rough and hard elements. Because there is no log layer, the displacement height d determines the position of the zero level and the rupture rate u0 can't be found by matching the speed information with the log rule.However, these parameters are still very important because they are used to scale static flows for external and rough layers.In this article we propose another method for evaluation in laboratory conditions. Where d of additional experiments is found to be quite grown with the log layer.We also describe a suitable method for evaluating the rupture rate u0 for low crescent flows. These methods have been used for our own lab experiments, with a harsh uniformity, where velocities were measured using a particle Image Speedometer. Results are interpreted in terms of the twice averaged Navier-Stokes equations and includes the mean of velocity, turbulence intensity, Reynolds actions of normal tension and rupture induced by form and shape. Information collapses well and show that in flows without a Log layer created, the turbulence structure in the outer layer remains similar to the turbulence structure of the flows with a log layer. This means that Even though the rough layer in the experiments reported here is high enough to prevent the growth and development of the Log layer, however, the effect of the substrate's roughness does not spread and diffused further into the outer layer,in addition, the results show that flow statistics do not depend on relative crescent, exceptfor tensions induced by the form that increases when partial crescent decreases.

Keywords: *Flow, Crescent Flow, Initial Speed, Reynolds*

BACKGROUND

Most natural open channel flows and ground flows belong to the category of rough hydraulic substrates. Therefore, science is required for rough substrates. Flows for river engineers and environmental scientists. Channel morphology (especially the effects of a uniform shape) and substrate local friction are major contributors to flows resistance, while the details of hydrodynamics of flows can affect strongly on organisms which are living in the fountain. Although the hydrodynamics of rough substrate flows have been widely studied for at least two decades but there are still many unresolved issues which are close to being clear, especially for small relative crescent (Ratio between average of water depth and height of roughness, $H_a$lk) for example, mountainous fountains.

Such flows are often studied using concepts which are basically created for large relative crescent.In flows with a large relative crescent, the logarithmic layer occupies an overlapping area between the outer layer and the inner layer (Fig. 1) and dimensional analysis leads to the well-known general speed logarithmic law, for rough substrate flows, this rule is used as follows:

$$\frac{\bar{u}}{u_*} = \frac{1}{k}\log\left(\frac{z-d}{z_0}\right) \quad (1)$$

Here, $\bar{u}$ =average of flow rate (the mark on u indicates the average of time), u_0 rupture rate, k general constant,d =Vonkarman the height of displacement which determines the real root situation of the log law of speed called zero level and z_0= The length of the roughness which depends on the characteristics of the roughness. In the upper region of the log that extends to the free surface, the speed level is given by the speed defect law:

$$\frac{U_m - \bar{u}}{u_*} = \frac{1}{k}\log\left(\frac{\delta}{z-d}\right) + \frac{2\Pi}{k} w\left(\frac{z-d}{\delta}\right) \quad (2)$$

Here δ =layer thickness, w = The function used to consider the effect of external shells and its effect on the flow under the (z-d)/ $\delta < 0.15 – 0.2$ is negligible which is considered as the upper limit of the logarithmic layer. ∏ as a close parameter as a dimensionless parameter of cloes and U_m = maximum speed is known. Below the logarithmic layer, there is a flow region called the rough layer which within it, the flow is directly affected by various rough elements and therefore it is not uniform in terms of space.

It's not possible to find a global law in the rough layer, because the rough layer geometry creates many long shells that affect the speed statistics. To address heterogeneity of the spatial flow, the twice averaged Navier-Stokes (DANS) equations were proposed as an appropriate theoretical framework. The development of this new method for rough substrates began It was led by atmospheric (aerology) scientists to describe and forecast the turbulent flows inside and above ground awnings, such as forests or shrubberies and in environmental hydraulics, the idea of spatial flow was used in a number of studies. Using the twice averaging method, Nikora (2004) proposed three classes of velocity schemes, namely, exponential, linear, or fixed, which depend on the geometry of the layer's roughness and flow conditions.

For the case of open channel flows or small relative crescent for which the substrate surface consists of rough elements of a size close to the depth of the flow, nearly finding theoretical debates for the existence of a universal law for Average of speed plans is difficult, or else it refers to flow statistics. The main reason for this problem is that the effect of both the internal or external shell parameters is felt through the depth of the flow (Fig. 1), Therefore, dimensional analysis and similarity discussions cannot be used. Katul and his colleagues have suggested that forH_aIk $<$ 10 an existing boundary layer theory that might fail, While Jimenez recommends a similarity hypothesis that can be used for onlyH_aIk $>$ 40.

Instead of classifying all kinds of flows based on the relative crescent, Nikora and colleagues use flow layers to distinguish between a variety of rough substrate below flows: type I with a rough layer, is a good log layer created and an outer layer, type II with a rough layer and an outer layer, type III where the rough layer occupies the entire depth of the flow and type IV where rough elements occur along the free surface. It is difficult to determine the distances of relative crescent of these types of flows because they also depend on the geometric characteristics of the roughness. For example, type I may occur in the lower crescent (For example, H_aIk$<$ 10), but with simple and effective rough elements that create a rough layer that still allows the development of the log layer.

The absence of the log law of the global speed and the main problem in studying flows with a relatively small crescent or flows is the type II. The physical meaning of the log law parameters that can be discussed by placing the Log formula over the information points for this type of flows. However, in order to compare information from different experiments, we still need a well-defined root of the normal substrate coordinates and also a speed scale which we scale the information with it. In other words, we need a method to evaluate d and u_0 in the absence of the global log law.

In this paper we present a method for evaluating the displacement height, d in laboratory experiments, which include rough substrate without a log layer (type II flows).We also describe the appropriate method for evaluating the rupture rate in these flows. These two flow parameters are used to interpret our experiments with Type II turbulent flow on a rough substrate consisting of circles of equal uniformity. This article is organized as follows:1) Twice Navier - Stokes equations are initially presented as a framework for complete analysis. 2) Then the equipment and methods used in the experiments are described, followed by a description of the method for evaluating d and u_0 and 3) In the results section, the dependence of the flow characteristics on the relative crescent was tested, which focuses on this issue that how to collapse different flow statistics when u_0 is used without the assumption of a log-layer set to scale them. Finally, it is shown from the considerations of the torque balance that a change in relative crescent may induce a redistribution of tension rupture during rough layer periods.

Twice Averaged Navier-Stokes Equations

The DANS equations are obtained by averaging the Navier-Stokes equations for two times. Once in time and then in space over the volume of parallel substrate or small thickness. These equations are used for two reasons: They make the spatial variability of averaged flow variables uniform, in time which is induced by rough elements as well as new meaningful physical expressions which justifies the water torque ejection due to the spatial heterogeneity of the averaged flow in time. A detailed mathematical analysis and derivation of equations can be found in Raupach, Corniero Lera, Gimenez-Cuto and colleagues.In our current paper, we propose certain equations that have been adapted by Nikora for open channel currents with a uniform turbulent flow and two-dimensional (2D) constant on a rough substrate with a free surface. The DANS equation in the flow direction is given as follows:

$$\phi \rho g S_b = f_x - \frac{\partial \phi \tau_{xz}}{\partial z} \tag{3}$$

$$\tau_{xz} = \rho\left\langle v \frac{\partial \overline{u}}{\partial z} \right\rangle - \rho\left\langle \overline{u'w'} \right\rangle - \rho\left\langle \tilde{u}\tilde{w} \right\rangle \tag{4}$$

$$f_x = -\frac{1}{dV}\iint \overline{p} n_x dS + \frac{1}{dV}\iint \mu\left[\frac{\partial \overline{u}}{\partial x} n_x + \frac{\partial \overline{u}}{\partial y} n_y + \frac{\partial \overline{u}}{\partial z} n_z\right] dS \tag{5}$$

The above equations, direct straight lines and brackets of the angle represent the time and spatial mean of variables of flows, respectively, while the first and last, indicate the fluctuations and spatial disturbances, respectively, that is the flow, side and normal coordinates of the substrate and speed component: P = density, g = gravity acceleration, Sb = bed gradient; v = kinetic viscosity; pressure;φ Porosity which is equal to the ratio of between volume which is occupied by the total average volume and fluid volume (φ above the upper rough surface) the part of unit vector within fluid n = { n_x , n_y , n_z } which is normal for the surface of the substrate.

The spatial averaging method provides additional phrases based on the averaged Reynolds equations in ancient times. These are the stresses induced by the shape and form, which are part of the stress of the rupture of the fluid which is given by equation (4) and the entire stretch is just under the harsh layer, and it shows the form of stretching and viscous stretch, that is the tension that the fluid enters various rough elements (on unit height and flow unit level) due to pressure and viscosity forces. The stress induced by the shape and expression of the torque projection induced by the corresponding shape is the product of spatial equivalence, Because the Reynolds stress is the product of the average of nonlinear expression time in the Navier-Stokes equations, and it shows the torque projection which is induced by the heterogeneity of the crescent flow. For modeling the purposes, the importance of examining these expressions in the DANS equations is needed for the different flow conditions and relative crescent.

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