

The vertical velocity profile in a river with uniform flow can be described by boundary layer theory. Early experiments were carried out by Nikuradse (1933) using uniform spheres, and later Schlichting (1936) using particles of varying shapes. The experiments produced the following formula for the vertical velocity profile for uniform flow (Schlichting, 1979):

$$\frac{U}{u_*} = \frac{1}{\kappa} \ln\left(\frac{30y}{k_s}\right) \quad (2.1.2)$$

U is the velocity, and it is a function of the distance, y , from the bed. The parameter κ is an empirical constant, equal to 0.4. The formula only applies for rough surfaces, and k_s is a roughness coefficient. It is equivalent to the particle diameter of the spheres glued to the wall to model roughness elements. The variable u_* is the shear velocity, given by:

$$u_* = \sqrt{\frac{\tau}{\rho}} \quad (2.1.3)$$

Eq. 2.1.2 is also called the logarithmic profile for the water velocity.