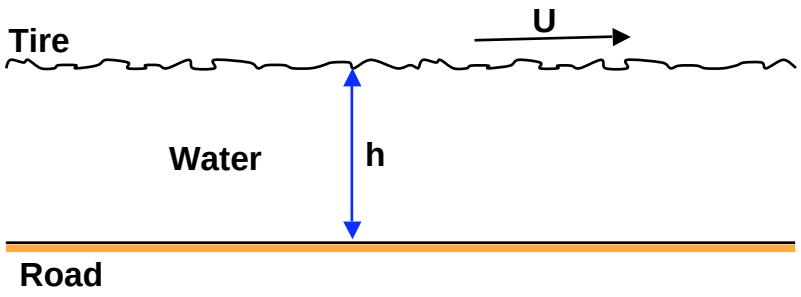
Problem 276B

The rough surface of an automobile tire consists of roughnesses of size, ϵ. Consider the following Couette flow which models the hydroplaning of the tire on a smooth road:



The speed of the tire is U, the mean liquid film thickness is h, and the kinematic viscosity of the liquid is ν. If the magnitudes of the unsteady turbulent velocities, u' and v', generated by the roughness are both given approximately by $U\epsilon y/h^2$ where y is the distance above the smooth road find the ratio of the "effective" dynamic viscosity of the film of liquid to the actual liquid dynamic viscosity. The answer includes U, ϵ, h and ν.