CVEN 5768 Homework Assignment 7
Due Monday March 05, 2007

Problem 1:

Consider the geometry of the radial permeability test. Let p_1 and p_2 be the applied pressures on the inner and outer surfaces of the test sample with inner radius R_1 and outer radius R_2. Let $\Delta p = p_2 - p_1$.

a)   Express $(p-p_1)/\Delta p$ in terms of r/R_1 and R_2/R_1.
b)   What is the expression of the seepage body force for convergent and divergent flow conditions ?

Problem 2:

Consider a rock mass cut by a single joint set with average spacing S and average aperture b. The intact rock permeability is defined as K_m. The joint permeability is equal to $K_j = gb^2/12v$ where g is the acceleration due to gravity (9.81 m/s^2 or 32.2 ft/s^2), b is the joint aperture, and v is the kinematic viscosity of the fluid (for water it is equal to 1.3 x 10^{-6} m^2/s or 14 x 10^{-6} ft^2/s at 20° C).

Show that the rock mass permeability is anisotropic with $K_\perp = K_m$ and $K_\parallel = K_m + K_j b/S \approx K_j b/S$.

Consider the following numerical example: b = 1 mm (0.04 in), $K_m = 10^{-5}$ cm/s and S varies between 0.1 m and infinity. Show the variation of $K_\parallel / K_\perp$ as a function of the joint spacing S.