

## Solution to Ex. 7.17

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Eq. (7.119) on the book is

$$u^+ = \frac{1}{\kappa} \ln\left(\frac{y}{s}\right) + B_2 \quad (1)$$

we have to associate friction factor  $f$  with  $u^+$ , here Eq. (7.106) and Eq. (7.107) come in handy. Considering Eq. (7.104), (7.107)  $\ominus$  (7.106) equals

$$\frac{\langle U \rangle}{u_\tau} - \frac{\bar{U}}{u_\tau} = u^+ - \sqrt{\frac{8}{f}} = \frac{3}{2\kappa} + \frac{1}{\kappa} \ln\left(\frac{y}{R}\right) \quad (2)$$

substitute  $u^+$  by Eq. (1) and rearrange, we get

$$\sqrt{\frac{8}{f}} = \frac{1}{\kappa} \left( \ln\left(\frac{y}{s}\right) - \ln\left(\frac{y}{R}\right) \right) - \frac{3}{2\kappa} + B_2 \quad (3)$$

the rest of the work is easy.