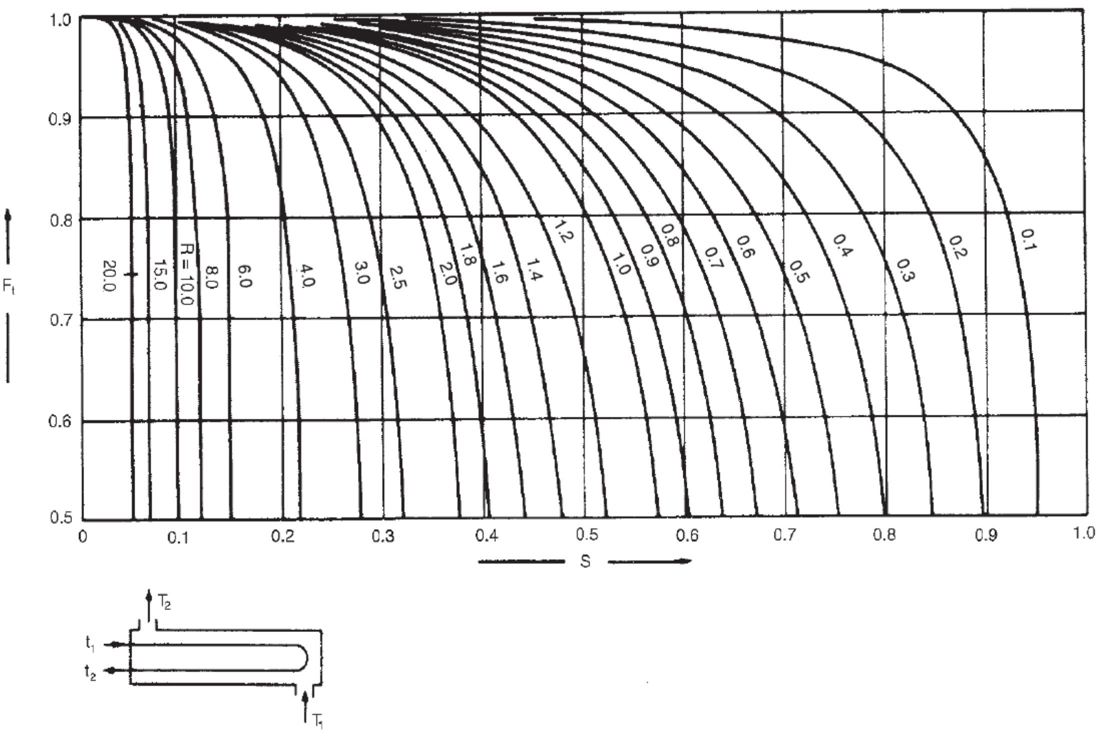
Laboratory and Homework Assignment 11

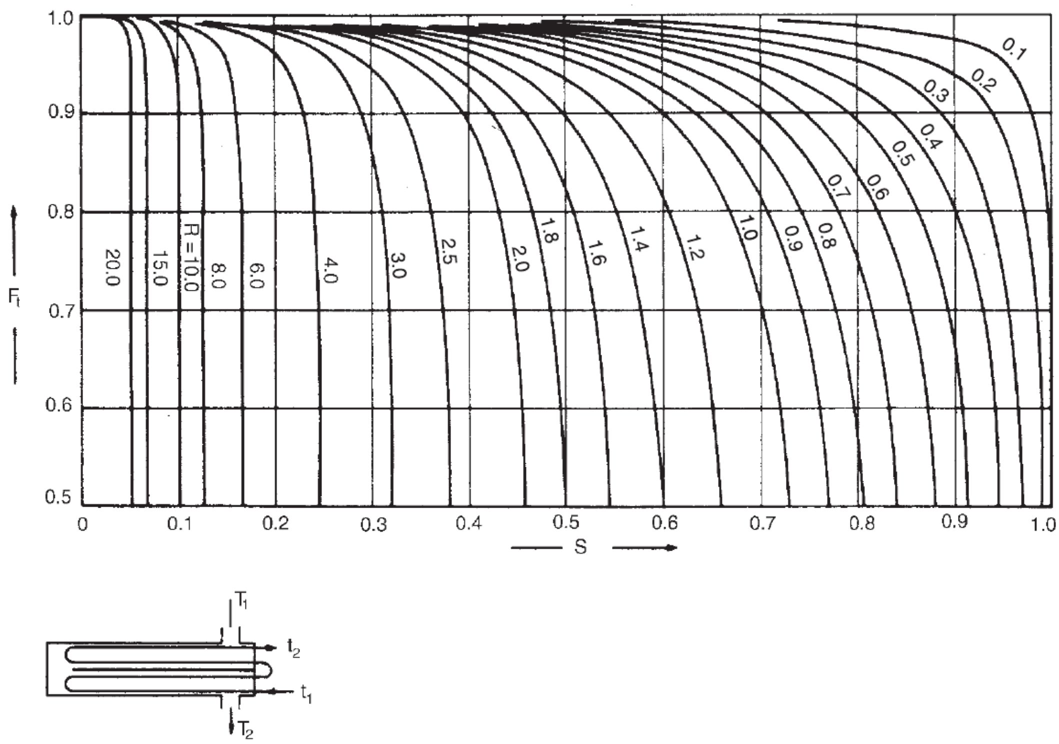
Reading Assignment

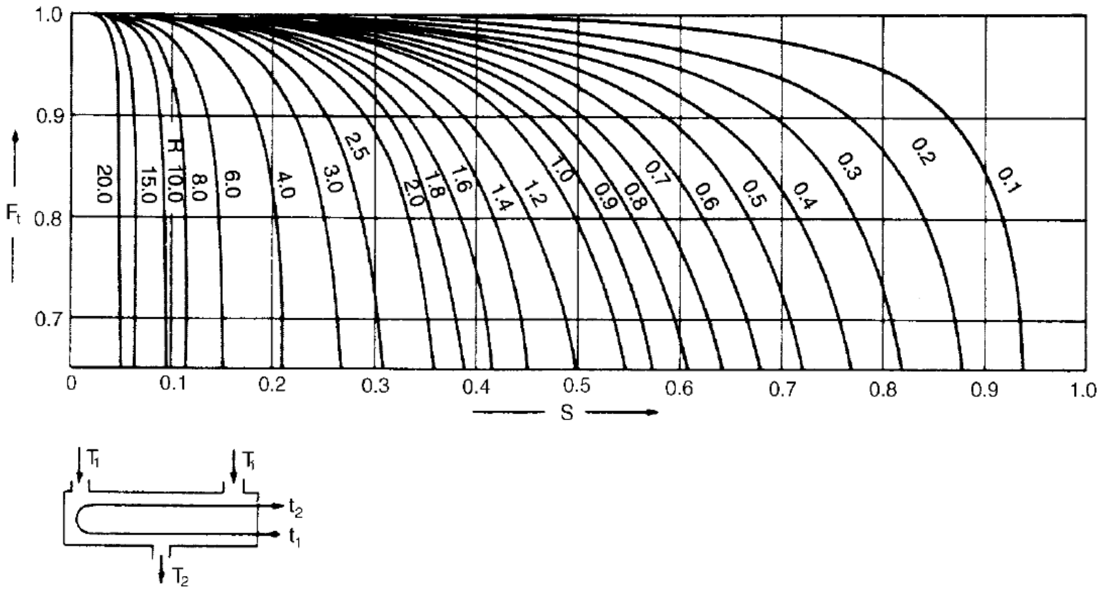
1. "Chapter 11: Bergman, Theodore L., and Frank P. Incropera. Fundamentals of heat and mass transfer. John Wiley & Sons, 2012.

Laboratory Assignment (Due after laboratory session)

1. Water at the rate of 68 kg/min is heated from 35 to 75 ° by an oil having a specific heat of 1.9 kJ/kg·$^{\circ}C$. The oil enters the exchanger at 110°C and leaves at 75°C. The overall heat transfer coefficient is 320 W/m^2·°C. This exercise needs to be done in matlab.
   (a) [10 points] Calculate the heat exchanger area when the fluids are used in a co-current double pipe heat exchanger.
   (b) [10 points] Calculate the heat exchanger area when the fluids are used in a counter-current double pipe heat exchanger. Compare the results with the co-current double pipe heat exchanger.
   (c) [30 points] Calculate the heat exchanger area when the fluids are used in a counter-current fashion in a shell-and-tube heat exchanger with the water making one-shell pass and oil making two tube passes.
2. [50points] Water at the rate of 3.8 kg/s is heated from 38 to 55 °C in a shell-and-tube heat exchanger. On the shell side one pass is used with water as the heating fluid, 1.9 kg/s entering the exchanger at 93 °C. The overall heat-transfer coefficient is 1419 W/m^2·°C, and the average water velocity in the 1.9cm diameter tubes is 0.366 m/s. Because of space limitations the tube length must not be longer than 2.5m. Calculate the number of tube passes, the number of tubes per pass, and the length of the tubes, consistent with this restriction using matlab. Use the following data to obtain the values of F_t. Now using the "shortcut" method for 'HeatX' in ASPEN, design the shell and tube heat exchanger. Compare the results with what you got in matlab. Are they same? If yes, why; if no, why?







***Taken from Sinnott, R. K., & Towler, G. (2009). Chemical engineering design: SI Edition. Elsevier.