Exercise 12

A fast exothermic chemical reaction was carried out in a pilot thin-film spinning disk reactor.

Pilot SDR dimensions and operational conditions:

Disk diameter	D_{pil}	0.10 m
Rotational speed	N_{pil}	1800 rpm
Liquid mass flowrate	Q_{pil}	18 kg/h

Physical properties

$\rho_L = 1000\ kg\ m^{-3}$

$\mu_L = 1 \cdot 10^{-3}\ Pa \cdot\ s$

$\lambda_L = 0.60\ Wm^{-1}K^{-1}$

Newtonian fluid, smooth laminar film.

Questions

1. Calculate the mean residence time in the reactor and the mean film thickness
2. Calculate the reactor size and operational conditions required to process 1000 kg/h of feed with the same product quality
3. Calculate the reactor size and operational conditions required to process 1000 kg/h of feed using five times the residence time used in the pilot unit.