ChE 323 Mass Transfer
Spring 2005

Homework # 3
Due Friday April 29

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Consider Example 3.2.9 of your text (pp. 67-68). Use MATLAB to obtain the full numerical solution to the boundary value problem described by equations 3.2.195-3.2.200. Note that the boundary value solver bvp4c can only solve systems of first-order equations. Therefore you must recast this problem as a system of first-order equations. Use the following values for the constants in the problem:

D_1 = 1.99e-5 m^2/s
D_2 = 4.55e-6 m^2/s
k = 3.33e-3 $m^3/mol.s$
C_{10} = 1.2 mol/m^3
C_{2L} = 0.8 mol/m^3
L = 0.4 m

(a) Submit a plot of the concentration profiles of species 1 & 2 in the film (on the same plot). Do they make sense qualitatively?
(b) Calculate the flux of species 1 at z = L.
(c) How big must k become before the approximation of equations 3.2.207 – 3.2.209 becomes valid?
(d) How does the result of part (a) change if D_1 = 4.55e-7 m^2/s? Is this result expected?