Independent variables, y_i

i			y(i)
1	ω_{A1}	Mass fraction of component A (solute) in lumen side	y(1)
2	ω_{A2}	Mass fraction of component A (solute) in shell side	y(2)
3	ω_{B1}	Mass fraction of component B (solute) in lumen side	y(3)
4	ω_{B2}	Mass fraction of component B (solute) in shell side	y(4)
5	u_1	Mass-averaged velocity of lumen-side stream	y(5)
6	u_2	Mass-averaged velocity of shell-side stream	y(6)
	ρ_1	Averaged concentration of mass-to-volume in lumen side	MassConc(1)
	ρ_2	Averaged concentration of mass-to-volume in shell side	MassConc(2)
	$j_{\mathrm{M,A}}$	Transmembrane mass flux of component A from the shell side to lumen side	MassFlux(A)
	$j_{\mathrm{M,B}}$	Transmembrane mass flux of component B from the lumen side to shell side	MassFlux(B)

$f_i(y_i, t)$

i	lhs	rhs	Pseudo code
1	$\frac{\mathrm{d}\omega_{\mathrm{A1}}}{\mathrm{d}z}$	$\frac{4}{d_1}\frac{\omega_{\mathrm{A1}}j_{\mathrm{M,B}}+(1-\omega_{\mathrm{A1}})j_{\mathrm{M,A}}}{\rho_1 u_1}$	Circum(1)/CSA(1) * (y(1)*MassFlux(B)+y(3)*MassFlux(A)) / (MassConc(1)*y(5))
2	$\frac{\mathrm{d}\omega_{\mathrm{A2}}}{\mathrm{d}z}$	$\frac{4d_1}{d_2^2-d_1^2}\frac{(\omega_{\mathrm{A2}}-1)j_{\mathrm{M,A}}-\omega_{\mathrm{A2}}j_{\mathrm{M,B}}}{\rho_2 u_2}$	- Circum(2)/CSA(2) * (y(4)*MassFlux(A)+y(2)*MassFlux(B)) / (MassConc(2)*y(6))
3	$\frac{\mathrm{d}\omega_{\mathrm{B1}}}{\mathrm{d}z}$	$\frac{4}{d_1}\frac{(\omega_{\mathrm{B1}}-1)j_{\mathrm{M,B}}-\omega_{\mathrm{B1}}j_{\mathrm{M,A}}}{\rho_1 u_1}$	- Circum(1)/CSA(1) * (y(1)*MassFlux(B)+y(3)*MassFlux(A)) / (MassConc(1)*y(5))
4	$\frac{\mathrm{d}\omega_{\mathrm{B2}}}{\mathrm{d}z}$	$\frac{4d_1}{d_2^2-d_1^2}\frac{\omega_{\mathrm{B2}}j_{\mathrm{M,A}}+(1-\omega_{\mathrm{B2}})j_{\mathrm{M,B}}}{\rho_2 u_2}$	Circum(2)/CSA(2) * (y(4)*MassFlux(A)+y(2)*MassFlux(B)) / (MassConc(2)*y(6))
5	$\frac{\mathrm{d}u_1}{\mathrm{d}z}$	$\frac{4}{d_1}\frac{[\rho_{\mathrm{A}}(\omega_{\mathrm{A1}}-\omega_{\mathrm{B1}})+2\rho_{\mathrm{B}}\omega_{\mathrm{B1}}]j_{\mathrm{M,A}}-[2\rho_{\mathrm{A}}\omega_{\mathrm{A1}}-\rho_{\mathrm{B}}(\omega_{\mathrm{A1}}-\omega_{\mathrm{B1}})]j_{\mathrm{M,B}}}{\rho_1^2}$	Circum(1)/CSA(1) * (MassFlux(B)-MassFlux(A))/MassConc(1) - y(5)/MassConc(1)*(Density(A)*rhs(1)+Density(B)*rhs(3))
6	$\frac{\mathrm{d}u_2}{\mathrm{d}z}$	$-\frac{4d_1}{d_2^2-d_1^2}\frac{[(\omega_{\mathrm{A2}}-\omega_{\mathrm{B2}})\rho_{\mathrm{A}}+2\omega_{\mathrm{B2}}\rho_{\mathrm{B}}]\,j_{\mathrm{M,A}}-[2\omega_{\mathrm{A2}}\rho_{\mathrm{A}}-(\omega_{\mathrm{A2}}-\omega_{\mathrm{B2}})\rho_{\mathrm{B}}]\,j_{\mathrm{M,B}}}{\rho_2^2}$	Circum(2)/CSA(2) * (MassFlux(B)-MassFlux(A))/MassConc(2) - y(6)/MassConc(2)*(Density(A)*rhs(2)+Density(B)*rhs(4))

I.C.

i		y(i), where z = 0	
1	$\omega_{\mathrm{A1}}(0) = \omega_{\mathrm{A10}}$	y(1) = InitMassFrac(A,1)	
2	$\omega_{\mathrm{A2}}(0) = \omega_{\mathrm{A20}}$	y(2) = InitMassFrac(A,2)	
3	$\omega_{\mathrm{B1}}(0) = \omega_{\mathrm{B10}}$	y(3) = InitMassFrac(B,1)	
4	$\omega_{\mathrm{B2}}(0) = \omega_{\mathrm{B20}}$	y(4) = InitMassFrac(B,2)	
5	$u_1(0) = u_{10}$	y(5) = InitVelocity(1)	
6	$u_2(0) = u_{20}$	y(6) = InitVelocity(2)	

Jacobi matrix $\partial f_i / \partial y_j$