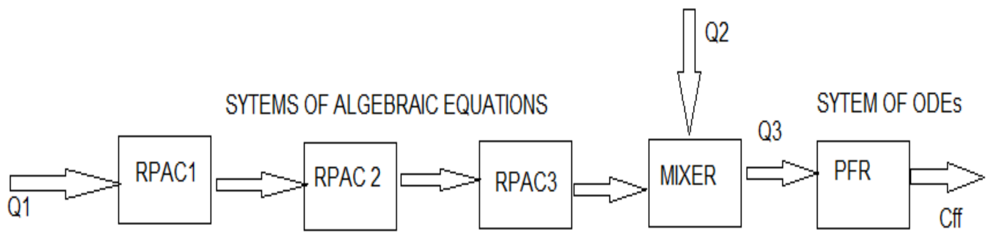
So my constrait in here its Q1 which can vary from 20 to 200

I had to find what value of Q1 in that intervale gives the higher posble value of Cff a the end of this problem (**concentraions of F a the final reactor)**

I have 3 RPACs (**systems of algebraic equations like example 2**) , values founds in one are used as initials values in the next one. the flow comming out of the third RPAC mix with a stream in a mixer resultung in the incomming conditions for the Final reactor (**sytem of diff equation like example 3**).

Look at the diagram in the right for better understanding



What happen betwen Rpacs it is not importan neather what happen in the mixer,
but what's comming out of the PFR **(differential equation sytem),**

Chaging Q1 result in an augmentation of Q3 since Q3=Q1+Q2(fixed)

How i did it?, i didnt know how to make it using mathcad's function. so i a proved values from 20 to 200, starting from 20 and increasing it by 5 till 200. i didnt have a good time :/.

Well i found **the higher value of Cff by fixing Q1=35 (Cff=1.93)**

how would you maximize the value of Cff at the final reactor(sytem of ODEs) by chaging Q1(in the beginning t of the systems of algrebraic equations)?

Conditions initiales

$Ca0 := 8$	$k1 := 0.01$	Varyng this variable subject to:	**Constraint:**
$Cb0 := 8$	$k2 := 0.005$	$Q1 := 115$	$20 \le Q1 \le 200$
$Cc0 := 0$	$k3 := 0.02$		
$Cd0 := 35$	$k4 := 0.001$		

Premier RPAC

Guess

$Ca1 := 5$ $Cb1 := 5$ $Cc1 := 3$ $Cd1 := 3$ $Vr1 := 50$

Given

Bilans de matiere

A: $$Ca0 = Ca1 + k1\cdot Ca1\cdot Cb1\cdot\frac{Vr1}{Q1}$$

B: $$Cb0 = Cb1 - 0.5\cdot k2\cdot Cc1\cdot\frac{Vr1}{Q1} + k1\cdot Ca1\cdot Cb1\cdot\frac{Vr1}{Q1}$$

C: $$Cc0 = Cc1 - k1\cdot Ca1\cdot Cb1\cdot\frac{Vr1}{Q1} + k2\cdot Cc1\cdot\frac{Vr1}{Q1}$$

D: $$Cd0 = Cd1 - k2\cdot Cc1\cdot\frac{Vr1}{Q1}$$

$$\begin{pmatrix} Ca1 \\ Cb1 \\ Cc1 \\ Cd1 \end{pmatrix} := \mathrm{Find}(Ca1, Cb1, Cc1, Cd1)$$

Les Concentration a la sortie

$Ca1 = 7.74$ $Cb1 = 7.74$ $Cc1 = 0.26$ $Cd1 = 35.001$

Deuxieme RPAC

Guess

$Ca2 := 1$ $Cb2 := 1$ $Cc2 := 1$ $Cd2 := 1$ $Vr2 := 100$

Given

Bilans de matieres

A: $$Ca1 = Ca2 + k1\cdot Ca2\cdot Cb2\cdot\frac{Vr2}{Q1}$$

B: $$Cb1 = Cb2 - 0.5\cdot k2\cdot Cc2\cdot\frac{Vr2}{Q1} + k1\cdot Ca2\cdot Cb2\cdot\frac{Vr2}{Q1}$$

C: $$Cc1 = Cc2 - k1\cdot Ca2\cdot Cb2\cdot\frac{Vr2}{Q1} + k2\cdot Cc2\cdot\frac{Vr2}{Q1}$$

D: $$Cd1 = Cd2 - k2\cdot Cc2\cdot\frac{Vr2}{Q1}$$

$$\begin{pmatrix} Ca2 \\ Cb2 \\ Cc2 \\ Cd2 \end{pmatrix} := Find(Ca2, Cb2, Cc2, Cd2)$$

Les Concentration a la sortie

$Ca2 = 7.279$ $Cb2 = 7.281$ $Cc2 = 0.718$ $Cd2 = 35.004$

Troisieme RPAC

Guess

$Ca3 := 0$ $Cb3 := 0$ $Cc3 := 0$ $Cd3 := 0$ $Vr3 := 500$

Given

Bilans de matieres

A: $$Ca2 = Ca3 + k1 \cdot Ca3 \cdot Cb3 \cdot \frac{Vr3}{Q1}$$

B: $$Cb2 = Cb3 - 0.5 \cdot k2 \cdot Cc3 \cdot \frac{Vr3}{Q1} + k1 \cdot Ca3 \cdot Cb3 \cdot \frac{Vr3}{Q1}$$

C: $$Cc2 = Cc3 - k1 \cdot Ca3 \cdot Cb3 \cdot \frac{Vr3}{Q1} + k2 \cdot Cc3 \cdot \frac{Vr3}{Q1}$$

D: $$Cd2 = Cd3 - k2 \cdot Cc3 \cdot \frac{Vr3}{Q1}$$

$$\begin{pmatrix} Ca3 \\ Cb3 \\ Cc3 \\ Cd3 \end{pmatrix} := Find(Ca3, Cb3, Cc3, Cd3)$$

Les Concentration a la sortie

$Ca3 = 5.807$ $Cb3 = 5.832$ $Cc3 = 2.143$ $Cd3 = 35.05$

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courrant d'entre

$Q1 = 115$ $Q2 := 30$

Courrant sortant des RPAC

$Ca3 = 5.807$
$Cb2 = 7.281$
$Cc3 = 2.143$
$Cd3 = 35.05$

Courrant de produit E

$Ce := 10$

Bilan de matiere

Q3 DEPENS OF Q1, Q2 IS FIXED

$Q3 := Q1 + Q2$

$Ca3 \cdot Q1 = Ca4 \cdot Q3$

$Cb3 \cdot Q1 = Cb4 \cdot Q3$

$Cc3 \cdot Q1 = Cc4 \cdot Q3$

$Cd3 \cdot Q1 = Cd4 \cdot Q3$

$Ce \cdot Q2 = Ce4 \cdot Q3$

$\rightarrow$

$Ca4 := \frac{Ca3 \cdot Q1}{Q3}$ $\quad Cd4 := \frac{Cd3 \cdot Q1}{Q3}$

$Cb4 := \frac{Cb3 \cdot Q1}{Q3}$ $\quad Ce4 := \frac{Ce \cdot Q2}{Q3}$

$Cc4 := \frac{Cc3 \cdot Q1}{Q3}$

Courrant de sortie

$Q3 = 145$

$Ca4 = 4.605$ $\quad Cd4 = 27.799$

$Cb4 = 4.625$ $\quad Ce4 = 2.069$

$Cc4 = 1.7$

Reacteur Tubulaire

Concentrations d'entre

$Ca4 = 4.605$ $\quad Ce4 = 2.069$

$Cb4 = 4.625$ $\quad Cf4 := 0$

$Cc4 = 1.7$ $\quad Cg4 := 0$

$Cd4 = 27.799$

Given

Bilans de matiere

A: $\frac{d}{d\tau} Ca(\tau) = -k1 \cdot Ca(\tau) \cdot Cb(\tau)$

B: $$\frac{d}{d\tau}Cb(\tau) = -k1\cdot Ca(\tau)\cdot Cb(\tau) + 0.5\cdot k2\cdot Cc(\tau)$$

C: $$\frac{d}{d\tau}Cc(\tau) = k1\cdot Ca(\tau)\cdot Cb(\tau) - k2\cdot Cc(\tau) - k3\cdot Cc(\tau)\cdot Ce(\tau)$$

D: $$\frac{d}{d\tau}Cd(\tau) = k2\cdot Cc(\tau) + k3\cdot Cc(\tau)\cdot Ce(\tau) - k4\cdot Cf(\tau)\cdot(Cb(\tau)\cdot Cd(\tau))^{0.5}$$

E : $$\frac{d}{d\tau}Ce(\tau) = -k3\cdot Cc(\tau)\cdot Ce(\tau)$$

F : $$\frac{d}{d\tau}Cg(\tau) = k4\cdot Cf(\tau)\cdot(Cb(\tau)\cdot Cd(\tau))^{0.5}$$

G : $$\frac{d}{d\tau}Cf(\tau) = k3\cdot Cc(\tau)\cdot Ce(\tau) - k4\cdot Cf(\tau)\cdot(Cb(\tau)\cdot Cd(\tau))^{0.5}$$

$Ca(0) = Ca4$ $Cb(0) = Cb4$ $Cc(0) = Cc4$ $Cd(0) = Cd4$

$Ce(0) = Ce4$ $Cf(0) = Cf4$ $Cg(0) = Cg4$

$$\begin{pmatrix} Caf \\ Cbf \\ Ccf \\ Cdf \\ Cef \\ Cff \\ Cgf \end{pmatrix} := Odesolve\left[\begin{pmatrix} Ca \\ Cb \\ Cc \\ Cd \\ Ce \\ Cf \\ Cg \end{pmatrix}, \tau, 300\right]$$

Reacteur V= 2000

Concentrations a la sortie

$Vr1 := 2000$ $\tau 1 := \frac{Vr1}{Q3}$

As you can see the varible $\tau 1$ (TAU) only depends on Q3 since Vr1 is fixed. and Q3 depends on Q1.

$\tau 1 = 13.793$

$Caf(\tau 1) = 2.798$

$Cbf(\tau 1) = 2.893$

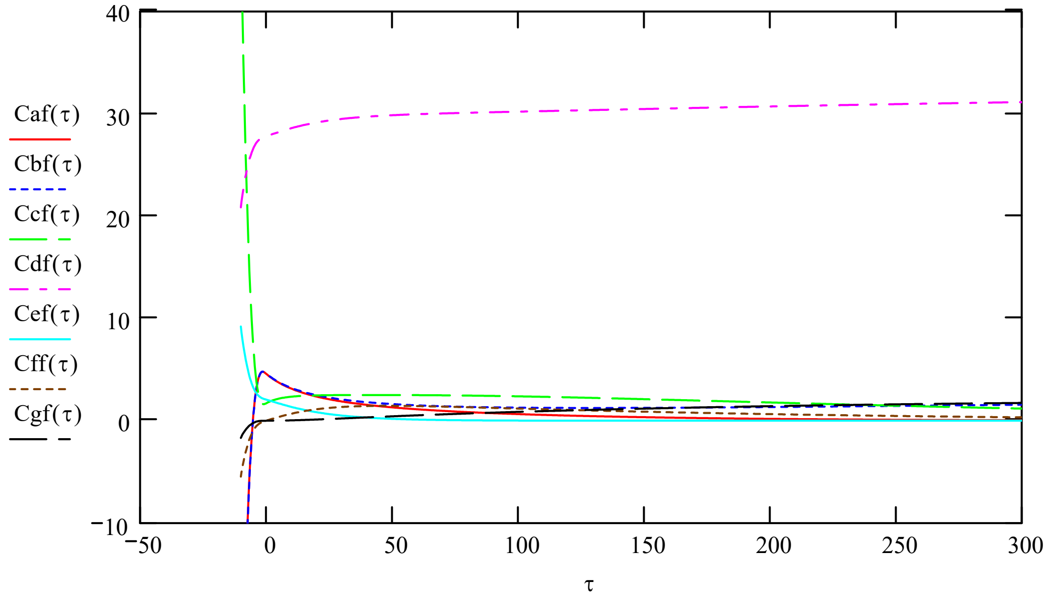
$Ccf(\tau 1) = 2.42$

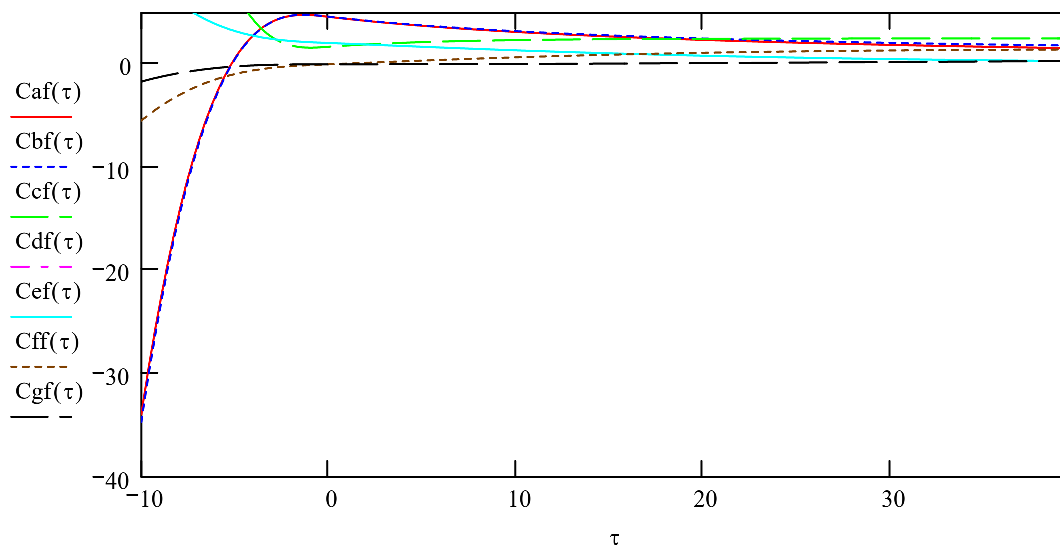
$Cdf(\tau 1) = 28.823$

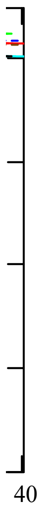
$Cef(\tau 1) = 1.132$

$Cff(\tau 1) = 0.874$ I WANT TO FIND THE MAXIMIUM VALUE OF Cff CHANGING Q1

$Cgf(\tau 1) = 0.063$







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