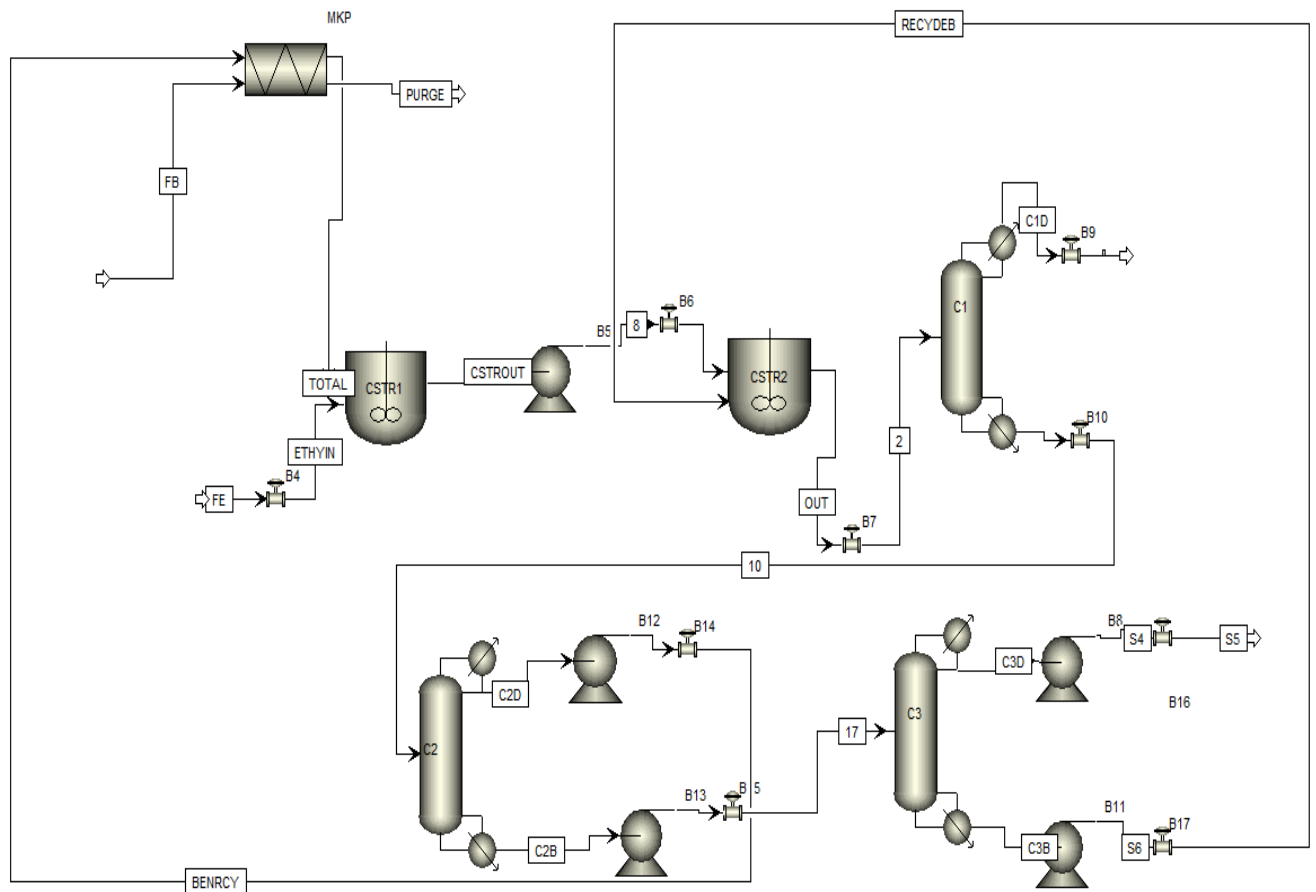


## CHE352: SIMULATION LAB 10

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fmincon was implemented on the code present in the appendix.

The variables altered to optimise the total cost were: -

- br\_p: benzene mole purity in the recycle stream from C2 distillate stream.
- deb\_p: ethylbenzene impurity in C3 bottom recycle stream
- br\_fr: benzene flow rate in the recycle stream

fmincon failed to optimise all the three variables for a large data set, so data set had to be estimated using multiple repetitive iterations of fmincon, varying different values.

Sl No	Initial Guess*	Lower Bound*	Upper Bound*	Optimised Values*	J=TAC final value (\$)
1	[0.96 0.02 190]	[0.96 0.02 180]	0.96 0.025 200]	[0.96 0.0222 189.9902]	1747200
2	[0.96 0.0222 189.9902]	[0.95 0.0222 189.9902]	[0.97 0.0222 189.9902]	[0.97 0.0222 189.9902]	1739200
3	[0.97 0.0222 189.9902]	[0.97 0.0222 189.9902]	[0.98 0.0222 189.9902]	[0.98 0.0222 189.9902]	1732100
4	[0.98 0.0222 189.9902]	[0.98 0.0222 189.9902]	[0.999 0.0222 189.9902]	[0.991 0.0222 189.9902]	1727700
5	[0.991 0.0222 189]	[0.985 0.02 185]	[0.995 0.023 195]	[0.9903 0.0219 194.9998]	1724500
6	[0.991 0.0222 189]	[0.985 0.02 185]	[0.995 0.023 210]	[0.9883 0.0216 209.9439]	1723900

\*Initial Guess, Lower Bound and Upper Bound, Optimised Values in the form of [br\_pr, deb\_p, br\_fr].

#### Final Optimised Values: -

- br\_p: 0.9883
- deb\_p: 0.0216
- br\_fr: 209.9439
- J = \$ 1723900

#### Appendix:

Code Used for optimising TAC using fmincon(MATLAB): -

```
global br_p br_fr deb_p
optim=optimset('fmincon')
```

```
optim.Display = 'iter'
```

```
[x,J] = fmincon (@(x)TAC(x),[0.91 0.02 190],[[],[],[],[],[0.9 0.015 180],[0.999 0.999 210],[],optim)
```

```
function J =TAC(x)
global br_p bz_fr deb_p

br_p = x(1);
deb_p = x(2);
bz_fr=x(3);
Aspen=actxserver('Apwn.Document.40.0');
[stat,mess]=fileattrib;
Aspen.invoke('InitFromArchive2',[mess.Name '\Lab 10.bkp']);
Aspen.Visible = 0;
```

```
Aspen.SuppressDialogs = 1;
```

```
%Supplying values to the simulation
```

```
Aspen.Application.Tree.FindNode('\Data\Blocks\C2\Subobjects\Design  
Specs\1\Input\VALUE\1').value=br_p;  
Aspen.Application.Tree.FindNode('\Data\Blocks\C3\Subobjects\Design  
Specs\1\Input\VALUE\1').value=deb_p;  
Aspen.Application.Tree.FindNode('\Data\Blocks\MKP\Input\OUTMLFL').value=bz_fr;
```

```
Run2(Aspen.Engine)
```

```
Run2(Aspen.Engine)
```

```
status=Aspen.Application.Tree.FindNode('\Data\Results Summary\Run-  
Status\Output\PER_ERROR').value;
```

```
if status==0
```

```
    C1Q = Aspen.Application.Tree.FindNode("\Data\Blocks\C1\Output\REB_DUTY").value;  
    C2Q = Aspen.Application.Tree.FindNode("\Data\Blocks\C2\Output\REB_DUTY").value;  
    C3Q = Aspen.Application.Tree.FindNode("\Data\Blocks\C3\Output\REB_DUTY").value;  
    hot = (C2Q)*0.0036*24*300*8.22+(C1Q)*0.0036*24*300*9.8+(C3Q)*0.0036*24*300*9.8;
```

```
    C1_CQ =
```

```
Aspen.Application.Tree.FindNode("\Data\Blocks\C1\Output\COND_DUTY").value;
```

```
    C2_CQ =
```

```
Aspen.Application.Tree.FindNode("\Data\Blocks\C2\Output\COND_DUTY").value;
```

```
    C3_CQ =
```

```
Aspen.Application.Tree.FindNode("\Data\Blocks\C3\Output\COND_DUTY").value;
```

```
    cold=(C1_CQ+C2_CQ+C3_CQ)*0.0036*24*300*0.354;
```

```
    opx = hot - cold;
```

```
    C1_N = Aspen.Application.Tree.FindNode("\Data\Blocks\C1\Input\NSTAGE").value;
```

```
    C1_N = double(C1_N);
```

```
    C1_D = Aspen.Application.Tree.FindNode("\Data\Blocks\C1\Subobjects\Column  
Internals\INT-1\Output\CA_DIAM6\INT-1\CS-1").value;
```

```
    C1_TOPT =
```

```
Aspen.Application.Tree.FindNode("\Data\Streams\C1D\Output\TEMP_OUT\MIXED").value;
```

```
    C1_BOTT =
```

```
Aspen.Application.Tree.FindNode("\Data\Streams\C1B\Output\TEMP_OUT\MIXED").value;
```

```
    C2_N = Aspen.Application.Tree.FindNode("\Data\Blocks\C2\Input\NSTAGE").value;
```

```
    C2_N = double(C2_N);
```

```
    C2_D = Aspen.Application.Tree.FindNode("\Data\Blocks\C2\Subobjects\Column  
Internals\INT-1\Output\CA_DIAM6\INT-1\CS-1").value;
```

```
    C2_TOPT =
```

```
Aspen.Application.Tree.FindNode("\Data\Streams\C2D\Output\TEMP_OUT\MIXED").value;
```

```
    C2_BOTT =
```

```
Aspen.Application.Tree.FindNode("\Data\Streams\C2B\Output\TEMP_OUT\MIXED").value;
```

```
    C3_N = Aspen.Application.Tree.FindNode("\Data\Blocks\C3\Input\NSTAGE").value;
```

```
    C3_N = double(C3_N);
```

```

C3_D = Aspen.Application.Tree.FindNode("\Data\Blocks\C3\Subobjects\Column
Internals\INT-1\Output\CA_DIAM6\INT-1\CS-1").value;
C3_TOPT =
Aspen.Application.Tree.FindNode("\Data\Streams\C3D\Output\TEMP_OUT\MIXED").value;
C3_BOTT =
Aspen.Application.Tree.FindNode("\Data\Streams\C3B\Output\TEMP_OUT\MIXED").value;

Fq1=10^(0.477+0.085*log(C1_N)-0.347*log(C1_N)^2);
A1=pi*(C1_D^2)/4;
CP1=10^(2.994+0.446*log(A1)+0.396*log(A1)^2);

TC_1 = CP1*C1_N*1.8*Fq1;

Fq2=1;
A2=pi*(C2_D^2)/4;
CP2=10^(2.994+0.446*log(A2)+0.396*log(A2)^2);

TC_2 = CP2*C2_N*1.8*Fq2;

Fq3=1;
A3=pi*(C3_D^3)/4;
CP3=10^(2.994+0.446*log(A3)+0.396*log(A3)^2);

TC_3 = CP3*C3_N*1.8*Fq3;

C1_CC = TC_1+17640*C1_D^1.066*((C1_N-2)*2*0.3048*1.2)^0.802+7296*(-
C1_CQ/(0.568*(C1_TOPT-298)))^0.65+7296*(C1Q/(0.852*(527-C1_BOTT)))^0.65;
C2_CC = TC_2+17640*C2_D^1.066*((C2_N-2)*2*0.3048*1.2)^0.802+7296*(-
C2_CQ/(0.568*(C2_TOPT-298)))^0.65+7296*(C2Q/(0.852*(457-C2_BOTT)))^0.65;
C3_CC = TC_3+17640*C3_D^1.066*((C3_N-2)*2*0.3048*1.2)^0.802+7296*(-
C3_CQ/(0.568*(C3_TOPT-298)))^0.65+7296*(C3Q/(0.852*(527-C3_BOTT)))^0.65;

vol_CSTR = 200;
D_CSTR = (2*vol_CSTR/pi)^0.333;
L_CSTR = 2*D_CSTR;
CSTR_C = 17460*(D_CSTR^1.066)*(L_CSTR^0.802);
cpx = C1_CC+C2_CC+C3_CC+2*CSTR_C;

J = cpx/3+opx;

else

J=10e10;
end
end

```