

FIGURE 6.1

	A	B	C	D	E	F	G
1	Lagrange Multiplier using Gauss Jordan Elimination						
2	Mixer Example						
3							
4							
5							
6							
7		F1	F2	F3	λ	RHS	
8	eq 6.13b	1	0	0	-50	245	
9	eq 6.13c	0	1	0	-50	240	
10	eq 6.13d	0	0	1	50	500	
11	eq 6.13e	1	1	-1	0	0	
12							
13	Solution from Gauss Jordan Elimination						
14							
15		1	0	0	0	250	F1
16		0	1	0	0	245	F2
17		0	0	1	0	495	F3
18		0	0	0	1	0.1	λ

FIGURE 6.13

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Newton Raphson Method													
2	Lagrange Multiplier													
3														
4														
5														
6	VBA Code	x(0)	x(1)	x(2)	x(3)	x(4)	x(5)	x(6)						
7	Equations	FH	FC	TH_In	TH_Out	TC_In	TC_Out	λ	RHS					
8	Nonlinear	1							10					
9	Nonlinear		1						20					
10	Nonlinear			1					90					
11	Nonlinear				1				51					
12	Nonlinear					1			20					
13	Nonlinear						1		43					
14	Nonlinear							1	1					
15														
16														
17		x(0)	x(1)	x(2)	x(3)	x(4)	x(5)	x(6)						
18		FH	FC	TH_In	TH_Out	TC_In	TC_Out	λ	RHS					
19		1	0	0	0	0	0	0	9.9359	FH		-9.6153	eq(6.15b)	
20		0	1	0	0	0	0	0	20.127	FC		-8.8261	eq(6.15c)	
21		0	0	1	0	0	0	0	89.517	TH_In		0	eq(6.15d)	
22		0	0	0	1	0	0	0	51.351	TH_Out		3.4E-15	eq(6.15e)	
23		0	0	0	0	1	0	0	19.516	TC_In		1E-15	eq(6.15f)	
24		0	0	0	0	0	1	0	43.826	TC_Out		-2E-14	eq(6.15g)	
25		0	0	0	0	0	0	1	-0.007	λ		Q hot	Q cold	
26												4566.97	4566.97	eq(6.15h)
27														
28												5	NL iterations	
29														
30		50	0	0.0972854	-0.070672452	0	0	-459.64	505.08					
31		0	12.5	0	0	0.048136	-0.08204	226.91	247.34					
32		0.0972854	0	2.0069283	0	0	0	-138.62	181.59					
33		-0.07067242	0	0	1.993071669	0	0	100.7	100.94					
34		0	0.048135654	0	0	2.028069	0	-138.94	41.517					
35		0	-0.082038494	0	0	0	1.97193	236.79	83.119					
36		459.643112	-226.9122103	138.62241	-100.7014649	138.9364	-236.792	0	-428.22					

FIGURE 6.15

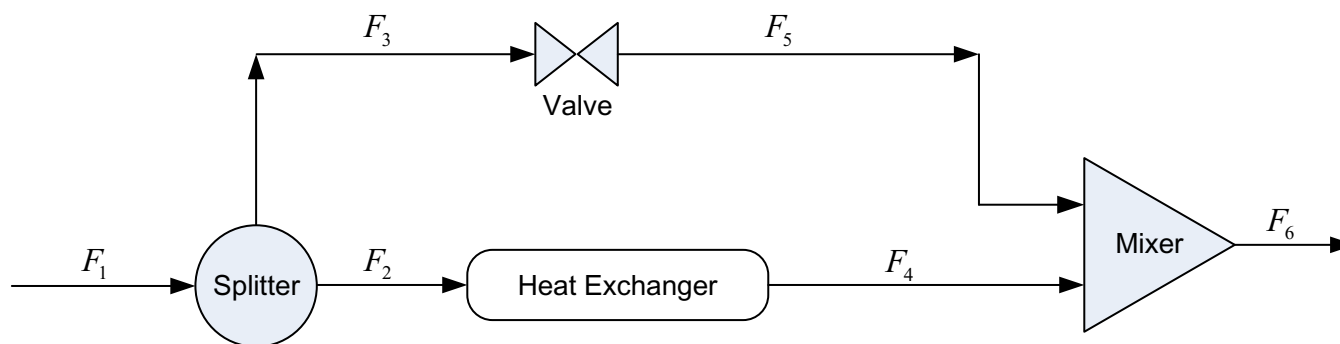


FIGURE 6.16

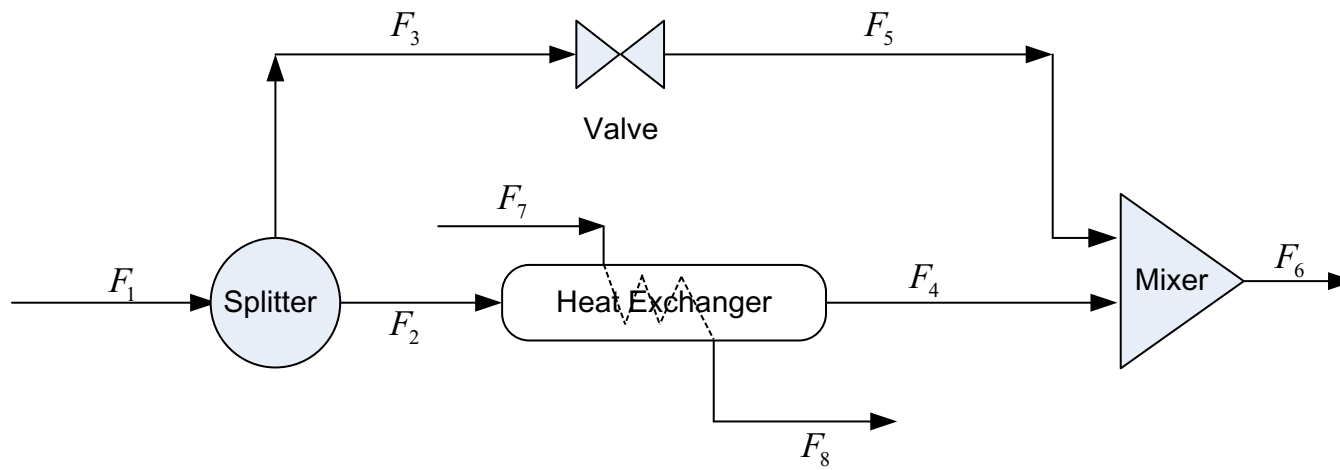


FIGURE 6.17

	A	B	C	D	E	F	G	H	I	J	K	L	M
2	Mass Flowrates and Weight %												
3													
4						C ₈ H ₁₀	56.86						
5	MW_C ₈ H ₁₀	106.1693				C ₈ H ₈	10359.51						
6	MW_H ₂ O	18.0153	C ₈ H ₁₀	5629.31		Total	10416.38		C ₈ H ₁₀	5686.22			
7	MW_C ₈ H ₈	104.1534	C ₈ H ₈	104.64		C ₈ H ₁₀ %	0.55		C ₈ H ₈	10464.29			
8	MW_H ₂	2.0159	Total	5733.95		C ₈ H ₈ %	99.45		Total	16150.51			
9			C ₈ H ₁₀ %	98.18					C ₈ H ₁₀ %	35.21		H ₂	200.51
10			C ₈ H ₈ %	1.82					C ₈ H ₈ %	64.79		H ₂ %	100
11						Sep 2							
12	C ₈ H ₁₀	10616.93											
13			Mixer			Reactor					3-Phase Sep 1		
14	H ₂ O	54045.90	C ₈ H ₁₀	16246.03					C ₈ H ₁₀	5686.22			
15			H ₂ O	54045.90		C ₈ H ₁₀ → C ₈ H ₈ + H ₂			H ₂ O	54045.90			
16			C ₈ H ₈	104.6429					H ₂	200.51		H ₂ O	54045.9
17			Total	70396.57					C ₈ H ₈	10464.29		H ₂ O %	100
18			C ₈ H ₁₀ %	23.08					Total	70396.92			
19			H ₂ O %	76.77					C ₈ H ₁₀ %	8.08			
20			C ₈ H ₈ %	0.15					H ₂ O %	76.77			
21									H ₂ %	0.28			
22									C ₈ H ₈ %	14.86			

FIGURE 6.2

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Styrene Flowsheet												
2	Mass Flowrates and Weight %												
3													
4						C ₈ H ₁₀	84.20						
5						C ₈ H ₈	10554.55						
6			C ₈ H ₁₀	6011.03		Total	10657.93		C ₈ H ₁₀	6011.49			
7			C ₈ H ₈	4.27		C ₈ H ₁₀ %	0.79		C ₈ H ₈	10270.71			
8			Total	6101.95		C ₈ H ₈ %	99.03		Total	16300.13			
9			C ₈ H ₁₀ %	98.51					C ₈ H ₁₀ %	36.88		H ₂	203.65
10			C ₈ H ₈ %	0.07					C ₈ H ₈ %	63.01		H ₂ %	100
11						Sep 2							
12	C ₈ H ₁₀	10350.25											
13			Mixer			Reactor					3-Phase Sep 1		
14	H ₂ O	53328.23	C ₈ H ₁₀	16568.37					C ₈ H ₁₀	5879.52			
15			H ₂ O	52485.17		C ₈ H ₁₀ -> C ₈ H ₈ + H ₂			H ₂ O	53672.75			
16			C ₈ H ₈	392.1507					H ₂	290.08		H ₂ O	53973.1
17			Total	70026.91					C ₈ H ₈	10697.76		H ₂ O %	100
18			C ₈ H ₁₀ %	23.66					Total	70752.37			
19			H ₂ O %	74.95					C ₈ H ₁₀ %	8.31			
20			C ₈ H ₈ %	0.56					H ₂ O %	75.86			
21									H ₂ %	0.41			
22									C ₈ H ₈ %	15.12			

FIGURE 6.3

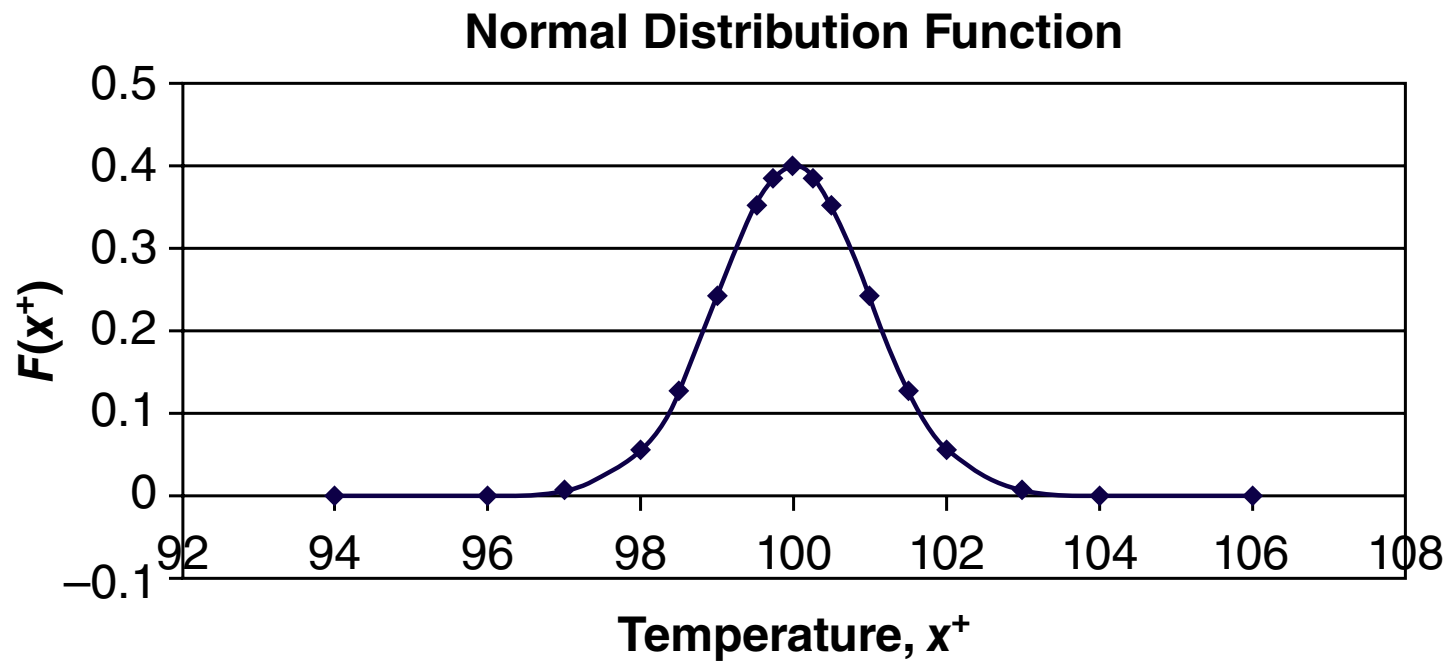


FIGURE 6.4

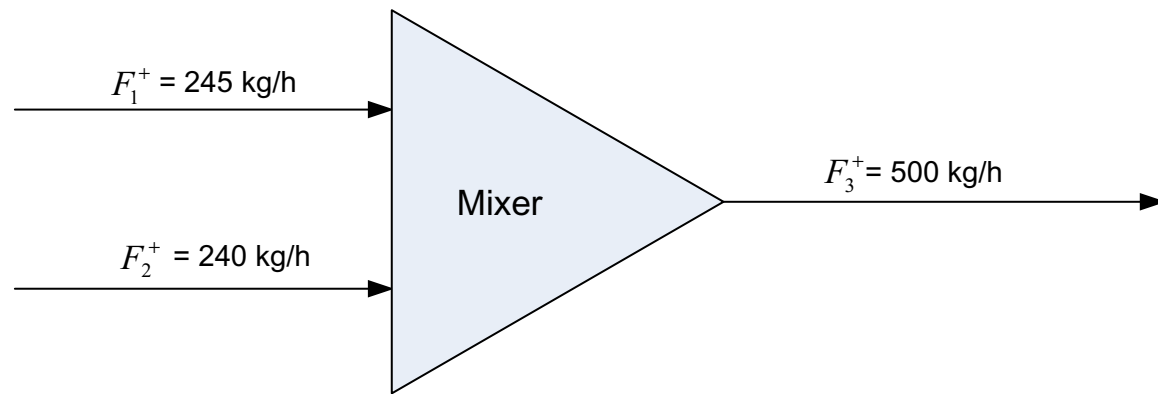


FIGURE 6.5

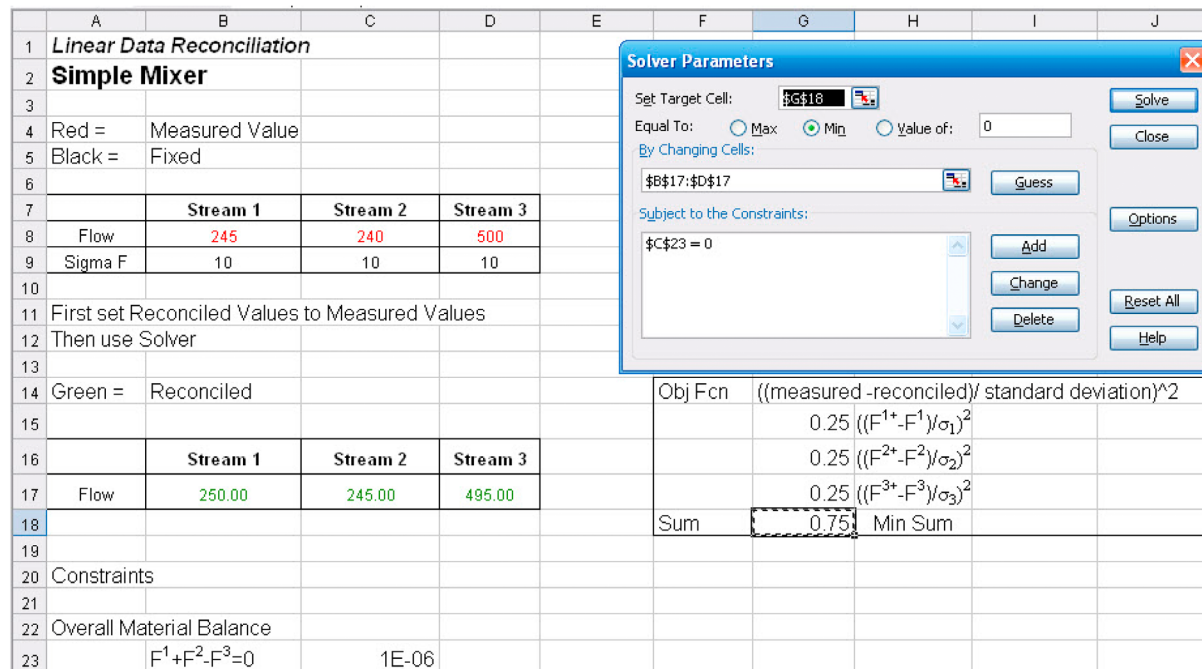


FIGURE 6.6

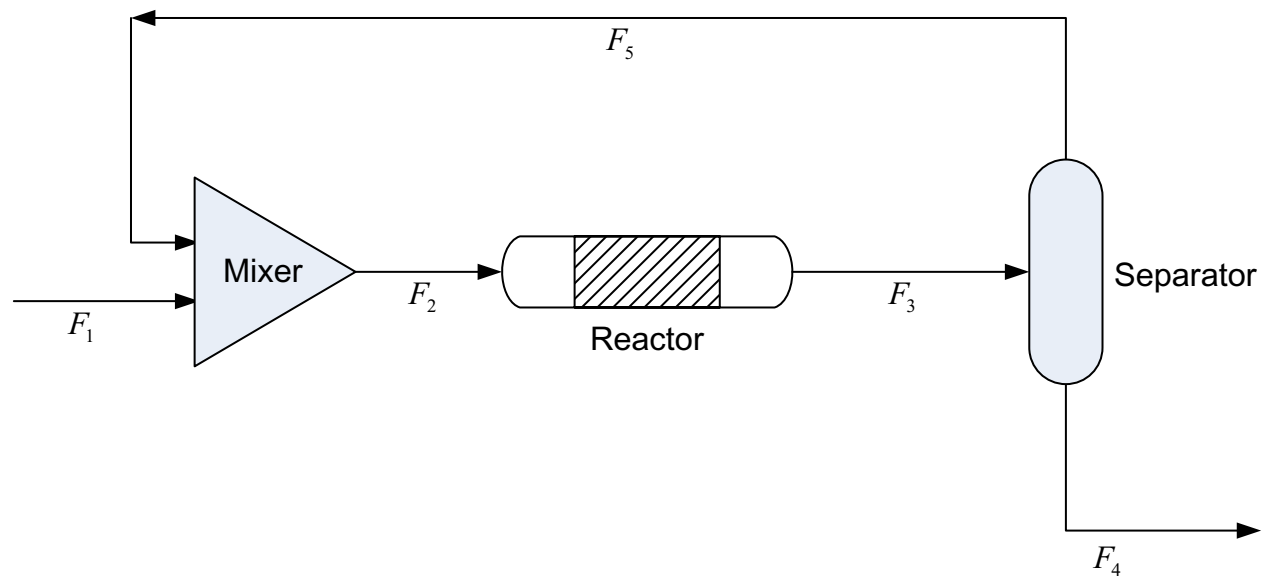


FIGURE 6.7

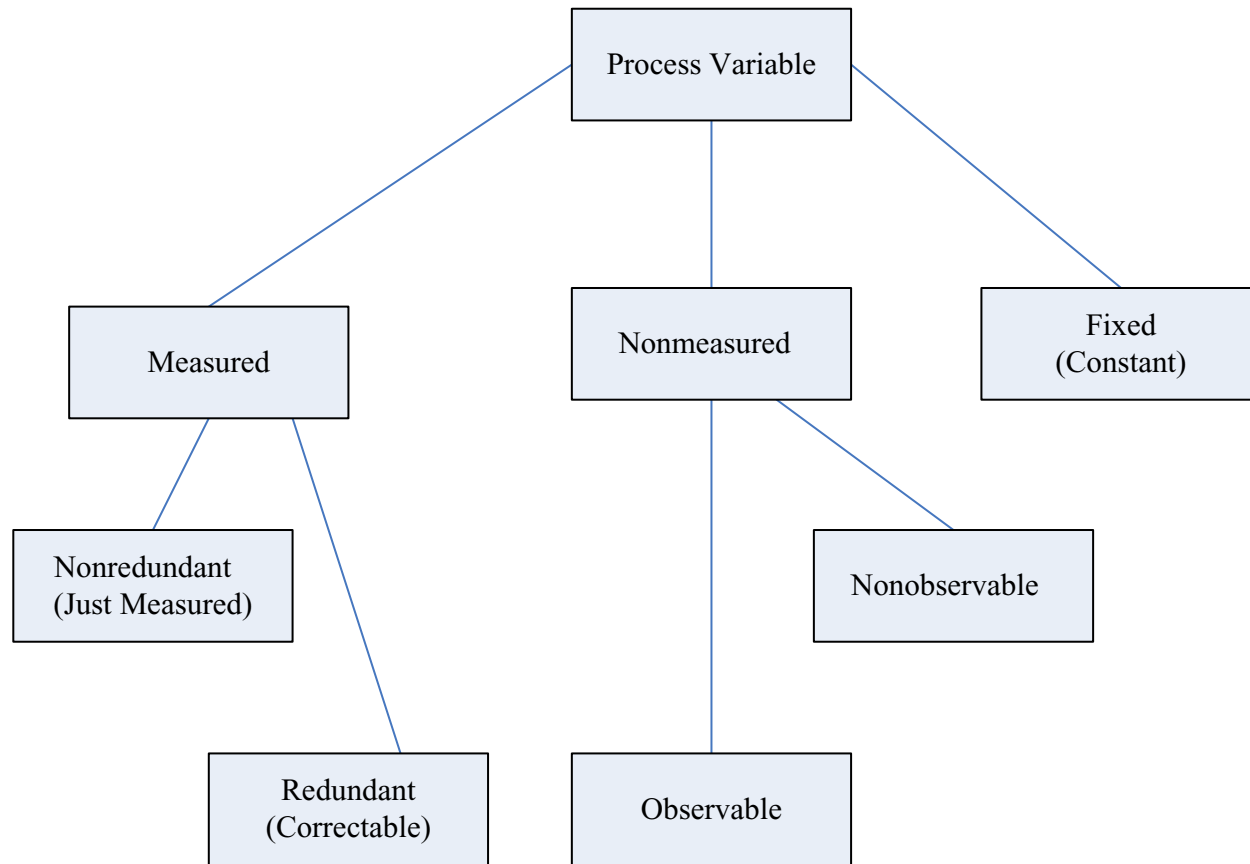


FIGURE 6.8

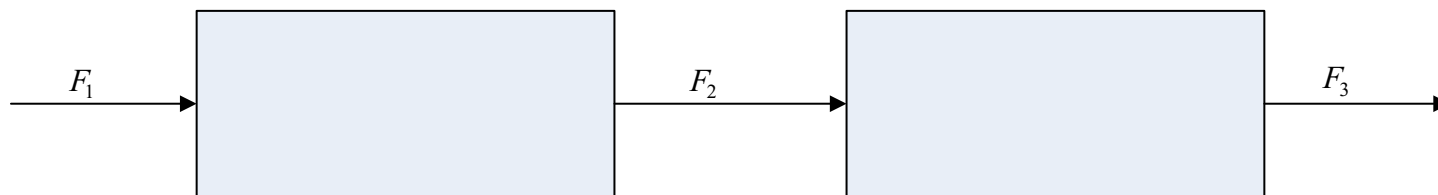


FIGURE p6.02

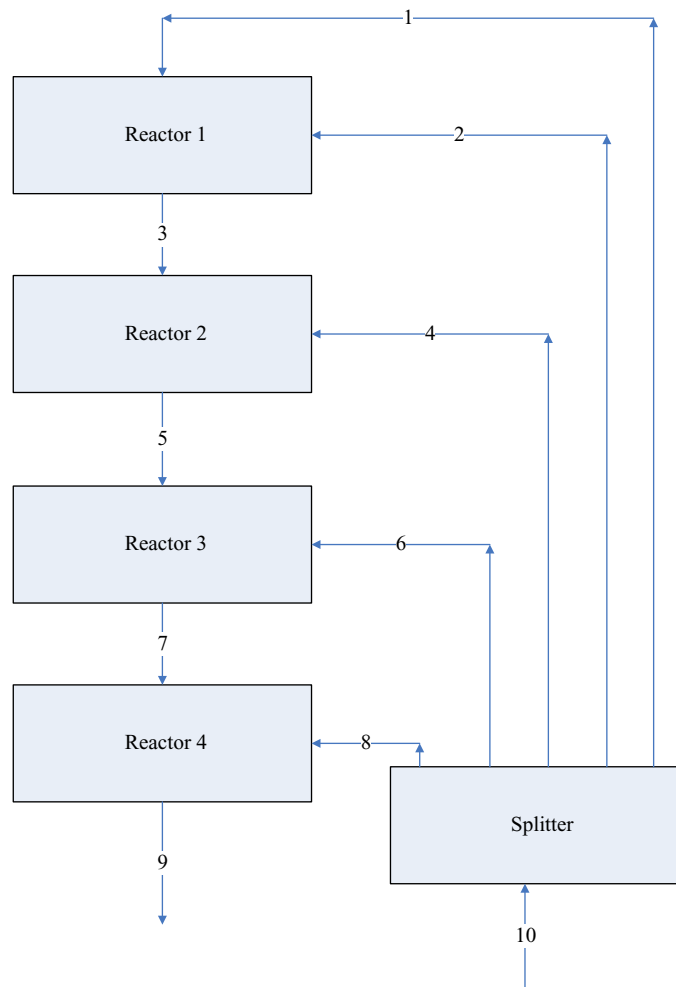


FIGURE p6.07

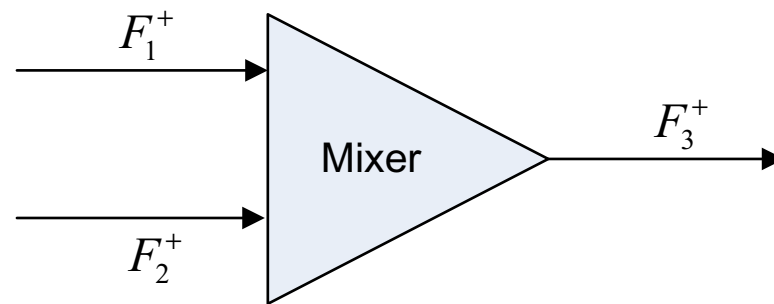


FIGURE p6.11



FIGURE p6.12

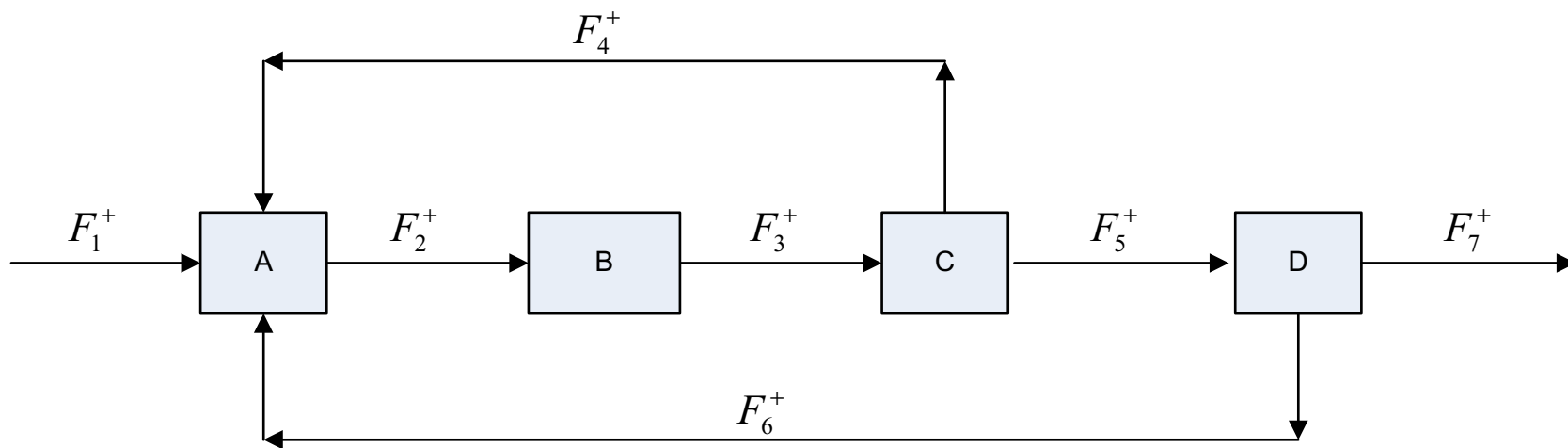
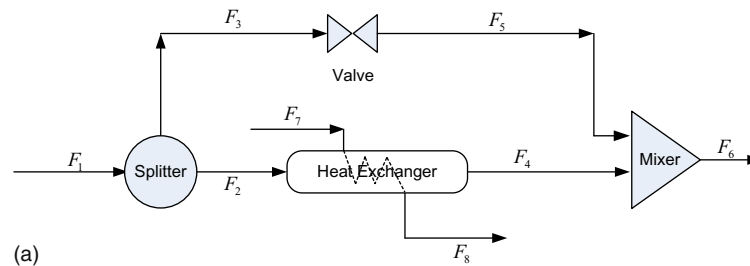


FIGURE p6.13



F1	F2	F3	F4	F5	A F6	F7	T2	T4	T5	T6	T7	T8
-1	1	1	0	0	0	0	0	0	0	0	0	0
0	1	0	-1	0	0	0	0	0	0	0	0	0
0	0	-1	0	1	0	0	0	0	0	0	0	0
0	0	0	1	1	-1	0	0	0	0	0	0	0
0.00	-867.27	0.00	421.30	0.00	0.00	206.34	-911.54	676.36	0.00	0.00	-991.02	1611.31
0.00	0.00	0.00	-421.30	-717.87	526.46	0.00	0.00	-676.36	-461.54	1144.35	0.00	0.00

(b)

					QATIAQATAQ or V							
0.668	-0.165	-0.167	-0.165	-0.167	-0.332	-0.003	0.015	-0.003	0.005	-0.013	0.016	-0.026
-0.165	0.673	0.162	-0.327	0.162	-0.165	-0.006	0.025	-0.037	-0.012	0.031	0.027	-0.044
-0.167	0.162	0.671	0.162	-0.329	-0.167	0.002	-0.010	0.033	0.017	-0.043	-0.011	0.018
-0.165	-0.327	0.162	0.673	0.162	-0.165	-0.006	0.025	-0.037	-0.012	0.031	0.027	-0.044
-0.167	0.162	-0.329	0.162	0.671	-0.167	0.002	-0.010	0.033	0.017	-0.043	-0.011	0.018
-0.332	-0.165	-0.167	-0.165	-0.167	0.668	-0.003	0.015	-0.003	0.005	-0.013	0.016	-0.026
-0.003	-0.006	0.002	-0.006	0.002	-0.003	0.009	-0.039	0.022	-0.005	0.012	-0.042	0.068
0.015	0.025	-0.010	0.025	-0.010	0.015	-0.039	0.171	-0.096	0.021	-0.052	0.186	-0.302
-0.003	-0.037	0.033	-0.037	0.033	-0.003	0.022	-0.096	0.282	0.144	-0.357	-0.104	0.170
0.005	-0.012	0.017	-0.012	0.017	0.005	-0.005	0.021	0.144	0.109	-0.270	0.023	-0.037
-0.013	0.031	-0.043	0.031	-0.043	-0.013	0.012	-0.052	-0.357	-0.270	0.670	-0.057	0.092
0.016	0.027	-0.011	0.027	-0.011	0.016	-0.042	0.186	-0.104	0.023	-0.057	0.202	-0.329
-0.026	-0.044	0.018	-0.044	0.018	-0.026	0.068	-0.302	0.170	-0.037	0.092	-0.329	0.535

(c)

FIGURE p6.14