# MATLAB CODE

close all; clear;

%Given data

x = [0 0.0417 0.0891 0.146 0.207 0.281 0.37 0.477 0.61 0.779 1];

HL = [7540 7125 6880 6915 7097 7397 7750 8105 8471 8945 9523];

HV = [48150 48250 48300 48328 48436 48450 48450 48631 48694 48950];

%composition in terms of mole fractions

xD = 0.7416;

xB = 0.016;

xF = 0.1436;

%Flow rates

F = 227.05;

D = 227.05\*(xB-xF)/(xB-xD);

B = F-D;

%Enthalpy-Concentration curves(linear regression)

hlcurve = polyfit(x,HL,1);

hvcurve = polyfit(x(1:length(HV)),HV,1);

%Enthalpy-Concentration curves(splines)

hv\_spline = spline(x(1:10),HV);

hl\_spline = spline(x,HL);

Hv1 = spline(x(1:10),HV,xD);

Hlo = spline(x,HL,xD);%Since total condenser, same comp as incoming v1

%Using the reflux ratio to get HD'

Hd = 2\*Hv1-Hlo;%NOTE: This is Hd'

Hf = 4790;

%Determining Hb by extrapolating teh Hd-Hf line

Hb = Hf + (xB-xF)\*(Hd-Hf)/(xD-xF);%NOTE: This is Hb'

a = linspace(0,1,10);

plot(a,polyval(hvcurve,a),a,polyval(hlcurve,a),xB,Hb,'rx',xF,Hf,'r+',xD,Hd,'ro');

%Eqbm data

xeqbm = [0 0.00792 0.016 0.0202 0.0417 0.0891 0.1436 0.281 0.37 0.477 0.61 0.641 0.706 0.779 0.86 0.904 0.95 1];

yeqbm = [0 0.0850 0.1585 0.191 0.304 0.427 0.493 0.568 0.603 0.644 0.703 0.72 0.756 0.802 0.864 0.902 0.9456 1];

pp = spline(yeqbm,xeqbm);

%Rectification line

m = linspace((Hd-Hf)/(xD-xF),(Hd-Hf)/(xD-xF)\*10,10);

fnrl = @(x)(m.\*(x-xD)+Hd - polyval(hlcurve,x));

fnrl2 = @(y)(m.\*(y-xD)+Hd - polyval(hvcurve,y));

x\_RL = fsolve(fnrl,zeros(1,10));

y\_RL = fsolve(fnrl2,zeros(1,10));

RL\_eqn = polyfit(x\_RL,y\_RL,1);

RL = @(x)(polyval(RL\_eqn,x));

%Stripping line

m = linspace((Hb-Hf)/(xB-xF),(Hb-Hf)/(xB-xF)\*10,10);

fnol = @(x)(m.\*(x-xB)+Hb - ppval(hl\_spline,x));

fnol2 = @(y)(m.\*(y-xB)+Hb-ppval(hv\_spline,y));

x\_SL = fsolve(fnol,zeros(1,10));

y\_SL = fsolve(fnol2,zeros(1,10));

SL\_eqn = polyfit(x\_SL,y\_SL,1);

SL = @(x)(polyval(SL\_eqn,x));

xcoords = linspace(0,1,10);

figure();

plot(xcoords,RL(xcoords),xcoords(1:3),SL(xcoords(1:3)),xeqbm,yeqbm);

%Stepping process

i = 0;

y\_c = xD;

x\_intersection = fsolve(@(x)(SL(x)-RL(x)),0);

y\_inters = RL(x\_intersection);

x\_c = 0;

xcoords = zeros(1,7);

ycoords = zeros(1,7);

xcoords2 = zeros(1,8);

ycoords2 = zeros(1,8);

xcoords2(1)= xD;

ycoords2(1) = xD;

while y\_c >= xB

i=i+1;

x\_c = ppval(pp,y\_c);

xcoords(i) = x\_c;

xcoords2(i+1) = x\_c;

ycoords(i)=y\_c;

if x\_c >= x\_intersection

y\_c = RL(x\_c);

else

y\_c = SL(x\_c);

end

ycoords2(i+1) = y\_c;

end

figure();

plot(xeqbm,yeqbm,x(1:6),SL(x(1:6)),xcoords2,RL(xcoords2),xcoords,ycoords,'x',xcoords2,ycoords2,'o');

%Actual Enthalpy calculation

Hda = spline(x,HL,xD);

Hba = spline(x,HL,xB);

%Flow rate calculations

D = F\*(xF-xB)/(xD-xB);

B = F - D;

%Heat duties

Qc = D\*(Hd-Hda);

QB = Qc + D\*Hda+B\*Hba-F\*Hf;

# MATLAB PLOTS





