```
clc;
clear all;
close all;

% Want: thrust, specific thrust, thurst specific fuel consumption

% Table 1: Parameters for cruise (index 1) and SLS (index 2)

vars.h = [10.67 * 10^3 0]; % m
vars.T_0_static = [218.8 288.15]; % K
vars.P_0_static = [0.239 1.014] * 10^5; % Pa
vars.Ma = [0.78 0];
vars.P_ratio_overall = [32 28];
vars.P_ratio_fan = [1.55 1.52];
vars.T_04 = [1450 1650]; % K
vars.m_dot = [110 265]; % kg/s
vars.BR = [10 10];

% Table 2: Engine Data

vars.P_02_over_00 = [0.998 1.00];
vars.eta_fan = [0.95 0.95];
vars.eta_comp = [0.89 0.89];
vars.eta_turb = [0.90 0.90];
vars.eta_nozz = [0.95 0.95];
vars.P_04_over_03 = [0.95 0.95];

%Other useful stuff
vars.k = 1.4;
vars.c_p = 1005; % J / kg * K
vars.R = 287;
vars.lhv= 42.8 * 10^6; %J/kg

%Pre fan and compressor calculations
vars.P_00=vars.P_0_static.*(1+((vars.k-1)/2)*vars.Ma.^2)...
          .^(vars.k/(vars.k-1));
vars.P_02=vars.P_02_over_00.*vars.P_00;
vars.T_00=vars.T_0_static.*(1+((vars.k-1)/2).*vars.Ma.^2);
vars.T_02=vars.T_00;
vars.T_013s=vars.T_02.*(vars.P_ratio_fan).^((vars.k-1)/vars.k);
vars.T_013=vars.T_02+(vars.T_013s-vars.T_02)./vars.eta_fan;
vars.P_013=vars.P_02.*vars.P_ratio_fan;

%Compressor
vars = compressor(vars);

%mdots
vars.m_dot_bp = vars.m_dot.*10./11;
vars.m_dot_core = vars.m_dot./11;

%Combustor
vars.P_04 = vars.P_04_over_03.*vars.P_03;
```

```
vars.q_dot = vars.m_dot_core.*vars.c_p.*(vars.T_04-vars.T_03);

%Turbine
vars = turbine(vars);

%Core Nozzle
vars.T_07 = vars.T_05;
vars.P_07 = vars.P_05;
vars.P_8 = vars.P_0_static;
vars.Ma_8s = sqrt((2./(vars.k-1)).*((vars.P_07./vars.P_8)...
             .^((vars.k-1)./vars.k)-1));
vars.T_8s = vars.T_07./(1+(vars.k-1)./2.*vars.Ma_8s.^2);
vars.T_8 = vars.T_07-vars.eta_nozz.*(vars.T_07-vars.T_8s);
vars.U_8 = sqrt(2.*vars.c_p.*(vars.T_07-vars.T_8));

%BP Nozzle
vars.P_18 = vars.P_0_static;
vars.Ma_18s = sqrt((2./(vars.k-1)).*((vars.P_013./vars.P_18)...
              .^((vars.k-1)./vars.k)-1));
vars.T_18s = vars.T_013./(1+(vars.k-1)./2.*vars.Ma_18s.^2);
vars.T_18 = vars.T_013-vars.eta_nozz.*(vars.T_013-vars.T_18s);
vars.U_18 = sqrt(2.*vars.c_p.*(vars.T_013-vars.T_18));

%intial velocity
vars.U_0 = vars.Ma.*sqrt(vars.k.*vars.R.*vars.T_0_static);

%Thrust and specific thrust
vars.F_thrust = vars.m_dot_core.*vars.U_8+vars.m_dot_bp.*...
                vars.U_18-vars.m_dot.*vars.U_0;
vars.spec_thrust=vars.F_thrust./vars.m_dot;

%Thrust-specific fuel consumption
vars.m_dot_fuel=vars.q_dot./vars.lhv;
vars.tsfc=vars.m_dot_fuel./vars.F_thrust


        vars =

                        h: [10670 0]
                T_0_static: [218.8000 288.1500]
                P_0_static: [23900 101400]
                        Ma: [0.7800 0]
           P_ratio_overall: [32 28]
               P_ratio_fan: [1.5500 1.5200]
                      T_04: [1450 1650]
                     m_dot: [110 265]
                        BR: [10 10]
             P_02_over_00: [0.9980 1]
                  eta_fan: [0.9500 0.9500]
                 eta_comp: [0.8900 0.8900]
                 eta_turb: [0.9000 0.9000]
                 eta_nozz: [0.9500 0.9500]
             P_04_over_03: [0.9500 0.9500]
                        k: 1.4000
```

```
       c_p: 1005
         R: 287
       lhv: 42800000
      P_00: [3.5722e+04 101400]
      P_02: [3.5651e+04 101400]
      T_00: [245.4236 288.1500]
      T_02: [245.4236 288.1500]
     T_013s: [278.1613 324.7685]
      T_013: [279.8844 326.6958]
      P_013: [5.5259e+04 154128]
       P_03: [1.1408e+06 2839200]
       T_03: [712.2879 803.4849]
   m_dot_bp: [100 240.9091]
 m_dot_core: [10 24.0909]
       P_04: [1.0838e+06 2697240]
      q_dot: [7.4140e+06 2.0495e+07]
       T_05: [638.5277 749.2069]
      T_05s: [548.3641 649.1188]
       P_05: [3.6049e+04 1.0301e+05]
       T_07: [638.5277 749.2069]
       P_07: [3.6049e+04 1.0301e+05]
        P_8: [23900 101400]
      Ma_8s: [0.7893 0.1500]
       T_8s: [567.7799 745.8517]
        T_8: [571.3173 746.0195]
        U_8: [367.5499 80.0418]
       P_18: [23900 101400]
     Ma_18s: [1.1631 0.7971]
      T_18s: [220.2813 289.8600]
       T_18: [223.2615 291.7018]
       U_18: [337.3605 265.2132]
        U_0: [231.2721 0]
   F_thrust: [1.1972e+04 6.5821e+04]
spec_thrust: [108.8329 248.3794]
 m_dot_fuel: [0.1732 0.4789]
       tsfc: [1.4470e-05 7.2753e-06]
```

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