Assignment - 5

Combustion Explosion and Detonation (AS 5640)

Department of aerospace Engineering, IIT Madras

Due date: **28/03/2019**

Assignment is to be submitted latest by 4pm on the above due date

1. Study the section “Detailed Analysis” (pg 269-274) of Laminar Premixed Flames of the Trun’s book. Also study the document PREMIX (sections 1 to 3) to review the governing equations, boundary conditions, Eigen value determination and solution procedure for the governing equations. FlameMaster uses same approach for solving 1D freely propagating laminar flame.

   Now, write down with your understanding the governing equations, boundary conditions, additional Eigen value condition for 1D steady freely propagating laminar premixed flame. Briefly discuss the solution procedure.

2. Using FlamMaster compute the flame speeds of *given fuel-air* mixtures at different equivalence ratios at an unburnt temperature of T_u= 298 K and pressure of 1 atm for φ from lean flammability limit to rich flammability limit.

   a) Plot S_L, flame temperature, T_f and flame thickness, δ_f all against φ.

   b) Plot major species Fuel, O2, H2O, CO, CO2 and T (temperature) along the flame at your φ.

   c) Plot radicals H, CH, OH, O and T (temperature) along the flame at your φ.

   d) Plot reaction rates of major species and T (temperature) along the flame at your φ.

   e) Plot flame speed, S_L, and flame temperature, T_f against φ for pressure of 10 atmosphere.

   f) Plot flame speed, S_L, and flame temperature, T_f against φ for T_u= 400 K

Sl. No	**RollNo**	**First Name**	Fuel, phi
1	AE09B028	Vasireddy Saiashwin	CH4-Air, 0.6
2	AE14B041	Harshal Mankar	CH4-Air, 1.0
3	AE14B044	Pratik Sutar	CH4-Air, 2.0
4	AE15B008	APOORVA BANERJEE	H2-Air, 0.6
5	AE15B031	RAJEEV KRISHNA S	H2-Air, 1.0
6	AE15B055	RAPARTHI SAITEJA	H2-Air, 2.0
7	AE16B109	RAKESH RAUSHAN	C4H10-Air,0.6
8	AE18D005	VIPIN KUMAR	C4H10-Air, 1.0
9	AE18D012	SUMIT SARMA	C4H10-Air, 2.0
10	AE18D014	ANUSAI R	C3H8-Air, 0.6
11	AE18D409	CHAUN BRIJ JAYDEEPBHAI	C3H8-Air, 1.0
12	AE18D410	GOMATHINAYAGAM N	C3H8-Air, 2.0
13	AE18M007	VALLURI RAVI PRASAD	CH4-Air,0.6
14	AE18M010	ADITYA WALIYA	CH4-Air, 1.0
15	AE18M011	ANKIT SAHAY	CH4-Air, 2.0
16	AE18M012	ARMAL NIKHIL DATTU	H2-Air, 0.6
17	AE18M016	GAUTHAM KRISHNAN	H2-Air,1.0
18	AE18M027	SAURABH ROY	H2-Air,2.0
19	AE18M028	SIBANANDA PANIGRAHY	H2-Air, 3.0
20	AE18M038	SHUBHAM KUMAR	C4H10-Air,0.6
21	AE19F001	Leo Coic	C4H10-Air, 1.0
22	AE18S021	ROHITH S K	C4H10-Air, 3.0
23	AE169F002	Marine Laumain	C4H10-Air, 2.0
24	AE18S026	VISHAL SRIVASTAV	C3H8-Air,2.0
25	AE18S046	GAGANA S	C3H8-Air, 1.0
26	ME16B067	RAGHAV KAKANI	C3H8-Air, 2.0
27	AE18S025	KINGSHUK CHAKRABORTY	C3H8-Air, 0.6