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Analysis of Computational Flow Network In Ngfpg

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Abstract
A gas turbine system is comprising of many subsystems. In the present work different sub-systems of the gas turbine are represented with schematic line diagrams. These sub-systems are having many roles to play while gas turbine is in operation. In the present manuscript these sub-systems are represented with line diagrams and mathematical modelling for them is presented afterwards. Gas turbine system is very complex system. Therefore, it can be analyzed without taking help from computational tools. In the present work a flow diagram regarding flow chart is also presented.
Keywords: *Computation, combustion, Gas Turbine.*

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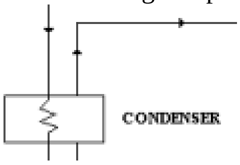
I. INTRODUCTION

In the present work a flow chart is developed to represent the working of gas turbine system. A gas turbine is comprising of following sections:
1. Air compressor
2. Combustion chamber
3. Gas turbine

These sections are interdependent .Mathematical modeling is represented below:



Mass of gases x difference in enthalpy= (1 – *mass of gases*) ($h_6 - h_5$)

Change in enthalpy in the process $= \frac{h_2 - h_6}{h_6 - h_5}$

$$= \frac{h_2 - h_5}{h_6 - h_5}$$

Mass of gases = Ratio of enthalpy $m = \frac{h_6 - h_5}{h_2 - h_5}$

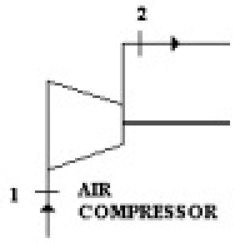


Figure 1. Line diagram for an air compressor

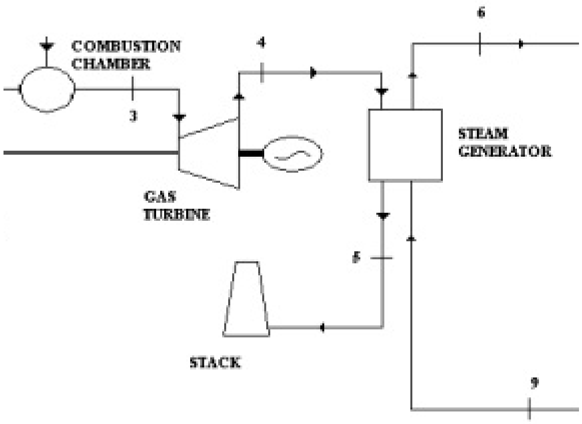


Figure 2. Line diagram for a combustion chamber and gas turbine section

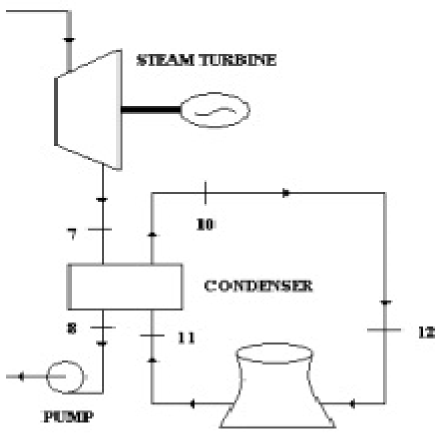


Figure 3. Line diagram for a combustion chamber and gas turbine section

II. METHODOLOGY

Computational programming tool is very effective programming tool. Main advantages are as following:
1. Accuracy is improved
2. Lesser time of calculation
3. Lesser cost of analysis
4. Higher reliability

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s2srefN2=Entropy(N2, T=T2s,P=P1)
s2srefO2=Entropy(O2, T=T2s,P=P1)
s2srefCO2=Entropy(CO2, T=T2s,P=P1)
s2srefH2O=Entropy(H2O, T=T2s,P=P1)
0=x1N2*(s2srefN2-s1refN2-R*ln(Prc))+x1O2*(s2srefO2-s1refO2-
R*ln(Prc))+x1CO2*(s2srefCO2-s1refCO2-R*ln(Prc))+x1H2O*(s2srefH2O-
s1refH2O-R*ln(Prc))
h2sN2=Enthalpy(N2, T=T2s)
h2sO2=Enthalpy(O2, T=T2s)
h2sCO2=Enthalpy(CO2, T=T2s)
h2sH2O=Enthalpy(H2O, T=T2s)
h2stotalair=x1N2*h2sN2+x1O2*h2sO2+x1CO2*h2sCO2+x1H2O*h2sH2O
h2totalair=h1totalair+((h2stotalair-h1totalair)/effcompressor)
h2N2=Enthalpy(N2, T=T2)
h2O2=Enthalpy(O2, T=T2)
h2CO2=Enthalpy(CO2, T=T2)
h2H2O=Enthalpy(H2O, T=T2)
h2totalair=x1N2*h2N2+x1O2*h2O2+x1CO2*h2CO2+x1H2O*h2H2O
```

III. MODELING AND ANALYSIS

Work generated in gas turbine = $W_T = (h_1 - h_2) + (h_3 - h_4)$= Net enthalpy output from the cycle

Work consumed in pump = $W_P = h_6 - h_5$= change in enthalpy in pump

Heat generated in combustion chamber= $Q_1 = (h_1 - h_6) + (h_3 - h_2)$

 Net efficiency obtained from the cycle = $\frac{W_T - W_P}{Q_1}$

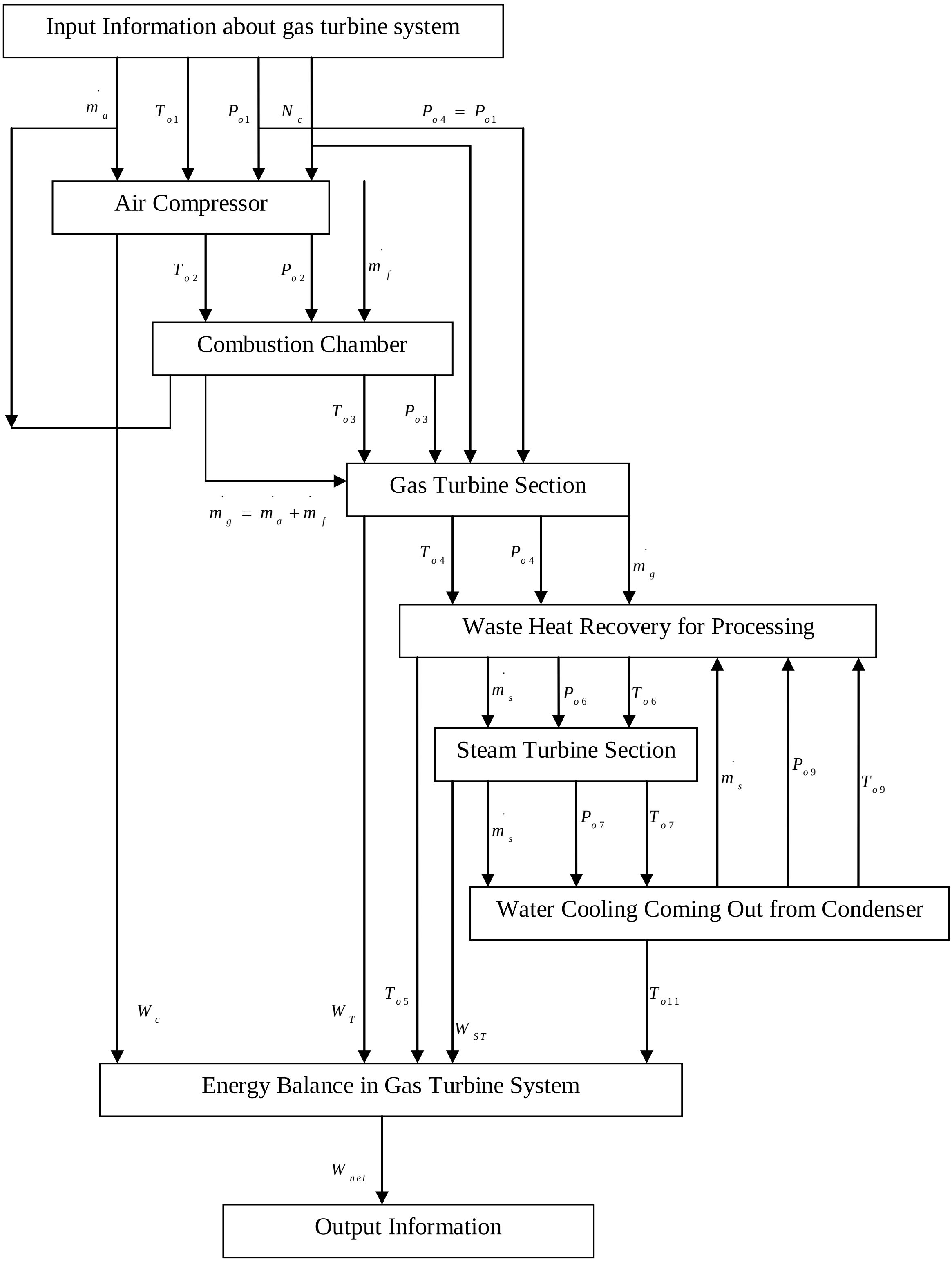

Figure 4. Flow chart representing the flow of mass and energy inside the gas turbine system

IV. RESULTS AND DISCUSSION

Gas turbine is having many sub-systems. These are as following:

1. Air filter system
2. Air compressor system
3. Air compressor blade system
4. Combustion chamber
5. Fuel supply system

6. Control system
7. Starting of engine system
8. Gas turbine section
9. Exhaust system

Table 1. Performance of gas turbine based thermal power plant

1000	1050	1100	1150	1200	1250
61.91	63.52	64.82	65.88	66.75	67.47
36.52	37.47	38.24	38.86	39.38	39.8
6447	6207	5965	5720	5472	5221
-13945	-15052	-16167	-17287	-18414	-19547
-22648	-24738	-26854	-28995	-31161	-33352
415.1	366.8	327.5	295.8	269.5	247.3
5.617	5.475	5.365	5.279	5.21	5.155
420.7	371.8	332.9	301.1	274.7	252.5
129154	127161	125742	124741	124053	123607
0.02389	0.02629	0.02872	0.0317	0.03366	0.03618
0.06574	0.07049	0.07531	0.08018	0.08511	0.09009
0.7564	0.7547	0.7522	0.7509	0.7489	0.747
0.1539	0.1486	0.1432	0.1378	0.1323	0.1267

Results obtained with the present mathematical modeling are very clear. These are summarized as below:

1. Dust is very harmful for the gas turbine system.
2. It should be removed with air filter.
3. Dust is of many types. Volcanic ash is most dangerous
4. During the dusting weather engine speed should be decreased.

Any part of the analysis which is presented above can be concluded as below.

V. CONCLUSION

In this section conclusions obtained from the present work are listed. It will be helpful for the researchers who will be working on gas turbine system:

1. Efficiency and work output both are important parameters in case gas turbine system analysis.
2. Work output from gas turbine system cannot be enhanced more than a limit.
3. Efficiency is mostly decreased with decrease in pressure losses.
4. All control systems should work properly for reliable operation of gas turbine.

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