Research Article

BOILER AUTOMATION USING MATLAB SIMULATION

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ARTICLE INFO	ABSTRACT
	In all types of chemical Industries/ Star Hotels/ Hospitals, boiler is a important process unit. Mainly steam boilers are needed. Steam as means of direct or indirect heating, system as a raw material, steam as a means of generating electricity. The management of a boiler's operation conditions is an obvious necessity. If we take into account that the excessive working parameters are the main hazardous problems because of the risk explosion. Boiler nominal state and to control them is difficult task because a steam boiler is a very complier system in which all the elements are connected. It is very difficult to carry out test directly on a boiler, both from the technical point of view dangerous derived from manipulating the operating and the economic point of view. Taking this into consideration we have to be look for an alternative method of analysis by simulation modules.

INTRODUCTION

The processes practiced in boiling water to generate steam in power plants are very complex and non linear. The analysis of the combustion process is determined powerfully on the burning practice and the shape and size of the combustion chamber. It would involve large use Fluid analysis to gain a thorough understanding of the flow regimes that a explained by partial non-linear differential equality. The heat barter to the water and hence to produce steam is also a method explained mathematically which can be decipher wholly with ample use of computer aided design packages by the way control system can be designed with much easier fact based on a series "bunch" parameters.

The important analysis of the problem was given by the simple equation that describe the complete process including the heat transfer to the water, the steam generation. The effect of combustion are allowed by considering that the combustion temperature depends on the fuel flow rate. Subsequent authors have followed this analysis.

The combustion temperatures effected fuel, air flow and the heat transfer characteristics.

Boiler

The principle of the boiler operation is simple: the aim is to evaporate water and super heat the steam obtained using the energy which released in a combustion reaction specifically,

the steam boiler which was chosen as basis for the model operates in the following way. Before the feed water entries into the actual steam boiler it passes to the a heat exchanger where it is pre heated before it enters the economizers saturated steam taken is used as the heating platform using the flue gases in the actual boiler as the heating medium, the water continuous to be transfer tempreature in the economizer but it does not turn into the vapour.

From the economizer, the water goes to the steam drum and from there it goes through the pipe for the downward transport of water into the drum. It is scatter through the different generation loop kindred with the boiler and the different section.

As the water rises through the tubes part of turns into the vapour, so that it forms a mix of vapour and water when it returns to the steam drum the steam produced in the drum must be divided from the water and for this purpose.

MATHEMATICAL PLAN MODEL

To plan the structure, of the steam boiler it has been break up into the different parts of which it is comprised modeling each one partially so that when they are fixed in one, we can simulate the over all behavior the boiler. The following are the important parts considered**:**

- Furnance
- All super heaters
- De superheaters

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- Eco
- Pre heater
- Boiler Drum
- Pipes
- Chimney

Each section is placed based on the laws of conservation of mass energy and momentum, aiming always for the correct balance between a consistently presentation of the system and the mathematical complication derived from. It is an assurance that can be expressed into the analysis of certain superposition's and the calculations of certain elements.

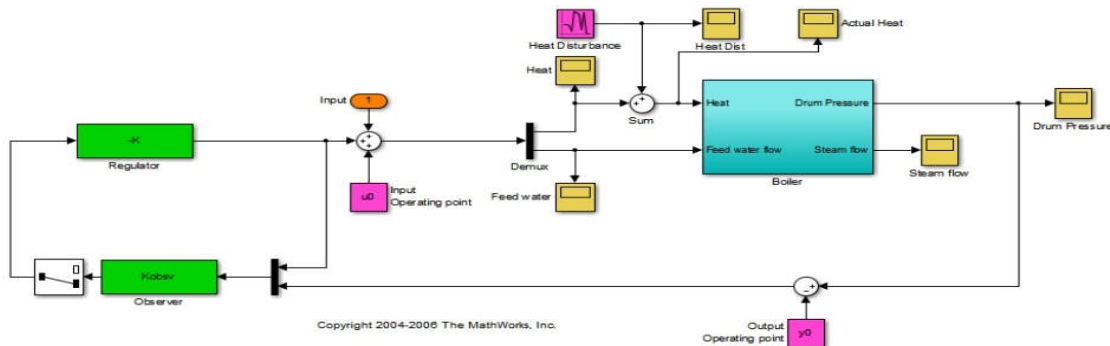Normally the laws of conservation can be translate mathematically as**:**

dM

------------   =Wentrada ----Wscalida + Wgeneracidur ----- Wconsumo +

dt

Wigenerado ----- Wiconsumido

where we is the mass flow rate of the gases. The overall output flows will give us the total amount of gas produced.

Proposed System Configuration

To begin, let's open the Simulink model.
Boiler_maintenance

The boiler control model's pre-load function initializes the controller magnitude. It is important because to calculate the operation point and linear model, the MATLAB model must be run. Note that x0, z0 are set after the operation point computation and are thus initially set to zero. The viewer and manager are calculate at the controller plan step and are also initially set to zero.

Step 2: Find an anticipate waged end and Proportionalize the Model

The model's inceptive state values are explicatein the MATLAB model. Using these values calculate the steady state operation point using the find-op function.

First, we'll create an operation point identification where the present values are known.

opiden = operiden('Boiler_maintenance');
opiden.States(1).Known = 1;
opiden.States(2).Known = 1;
opiden.States(3).Known = [1;1];

Now, let's adjust the operation point identification to show these the inputs must be calculate and that they are least bounded.

opiden. Inputs (1).Known = [0;0];   % Inputs unknown
opiden. Inputs (1).Min = [0;0];   % Input smallest value
Finally, we'll add an output identification to the performance point remembrance ; this is dominant to ensure that the output operation point is calculated during the solution process.
opiden = addoutputiden(opiden,'Boiler_maintenance/Boiler',1);
opiden. Outputs(1).Known = 0;   % Outputs unknown
opiden. Outputs(1).Min = 0;   % Output least value
Next, we enumerate the operation point and create a report.
[opSS,opReport] = findop ('Boiler_maintenance', opiden);
 Operation Point Hunt Report:

Operation Report for the Model 'Boiler_maintenance'.
 (Time-Varying elements calculated at time t=0)

Operation point identification were easily achieved.
States:

(1.) Boiler_Demo/Boiler/Steam volume
a: 5.6   da: 7.85e-13 (0)

a: 180   da: -5.93e-14 (0)
(3.) Boiler_Demo/Observer/Internal
a: 0   da: 0 (0)
a: 0   da: 0 (0)

Inputs:

(1.) Boiler_Demo/Input
x: 2.41e+05   [0 Inf]
x: 100   [0 Inf]

Outputs:

(1.) Boiler_Demo/Boiler
y: 1e+03   [0 Inf]

Before proportionalizing the model around this point, we'll identify the input and output indicator for the proportional model.

First we identify the input points for linearization.
Boiler_io(1) = linio('Boiler_maintenance/Sum',1,'input');
Boiler_io(2) = linio('Boiler_maintenance/Demux',2,'input');

Now we identify the open loop output points for assessing the local stability.

Boiler_io(3) = linio ('Boiler_maintenance/Boiler',1,'openoutput');
setlinio('Boiler_maintenance', Boiler_io);
In this code, we perceive a sequential model around the chosen operation point.
Lin_Boiler = linearize ('Boiler_maintenance',opSS,Boiler_io);
Finally, using the real function, make sure that the model is a least realization, (e.g., there are no pole zero rejection).
Lin_Boiler = real(Lin_Boiler);
1 state removed.

Step 3: Organizing a Regulator and State Observer

Using this linear model, we will design an Linear Quadratic Regulator and Kalmanfilter. Find the controller consideration to make sure that the controller is working around the chosen proportional point by retrieving the computed operating point.

a0 = op Report. Inputs.x;
z0 = op Report. Outputs.z;

Now design the regulator using the Linear Quadratic Regulator function. Note that strict regulation of the output is required while input disturbance should be limited.

Q = diag(1e8);   % Output proclamation
R = diag([1e2,1e6]);   % Input restriction

[K,S,E] = lqry(Lin_Boiler,T,E);

Design the Kalman filter using the kalman expression. For this example the main tumult origin is process tumult. It goes into the arrangement only through single input, hence the form of O and P.
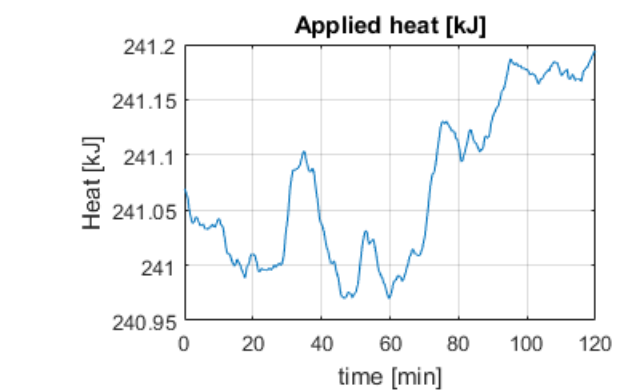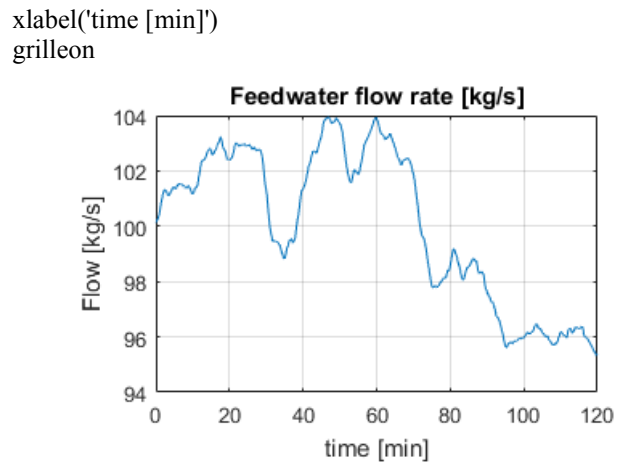
[M,N,B,V] = sdata(Lin_Boiler);
O = [B(:,1)];
P = [0];
qn = 1e4;
rn = 1e-1;
nn = 0;
[Kobsv,L,P] = kalman(s(M,[N O],B,[V P]),qn,rn);

Step 4: Imitiate and Test

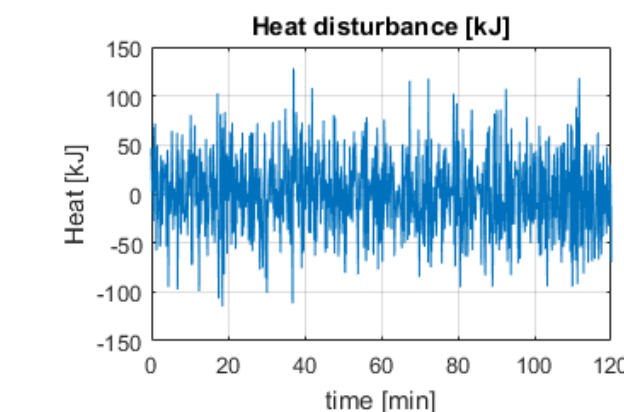For the designed controller the system configurations are shown below.

Sim ('Boiler_maintenance')
Here is the feed water actuation indication in kg/s
figSize = [0 0 360 240];
i = figure (1); plot (H2O.time/60, H2O.signals.values)
i.Color = [1 1 1];
i.Position = figSize;
title ('H2O f rate [kg/s]');
ylabel('F [kg/s]')
xlabel ('tym [min]')
grilleon

This illustrates the heat actuation signal in kJ:
i = figure (2); plot (Heat. time/60, Heat. signals. values)/1000)
i.Color = [1 1 1];
i.Position = figSize;
title ('heat [kJ]');
ylabel ('Heat [kJ]')

xlabel('time [min]')
grilleon

The next figure shows the heat disturbance in kJ. Note that the interruption changes by as much as half percent of the normal heat value.

i = figure(3);
plot(Heatinterupt.time/60,Heatinterupt.signals.values)/1000)
i.Color = [1 1 1];
i.Position = figSize;
title('Heat interruption [kJ]');
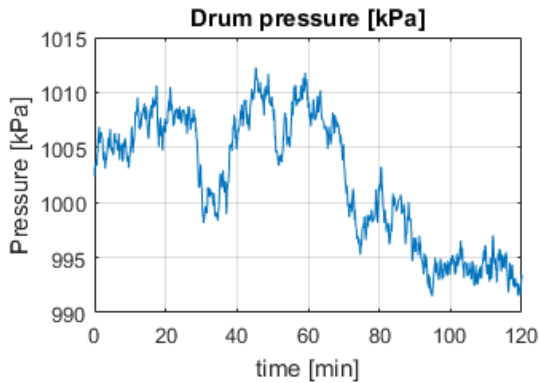ylab('Heat [kJ]')
xlab('time [min]')
grilleon

The drawing below indicate the analogus drum pressure in kPa. Notice how the pressure changes by about 1% of the nominal value infact the interruption is relatively huge.
i =figure(4);
plot(DrumPressure.time/60,DrumPressure.signals.values)
i.Color = [1 1 1];

```
i.Position = figSize;
title('Drum pressure [kPa]');
ylabel('Pressure [kPa]')
xlabel('time [min]')
grilleon

bdclose('Boiler_Demo')
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Drum pressure [kPa]

CONCLUSION

This paper shows the simulation of simple boiler used in industries, hotel, hospital using MATLAB. The concept behind this project is to improve the efficiency of boiler and to remove the manual interruption. This model can also help in swell the steam characteristics which in turn help to increase the boiler life. The purpose of this model is to reduce the fuel usage, hazardous situation that transpirein future in the field near by the furnance.

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