

Single Board Heating System

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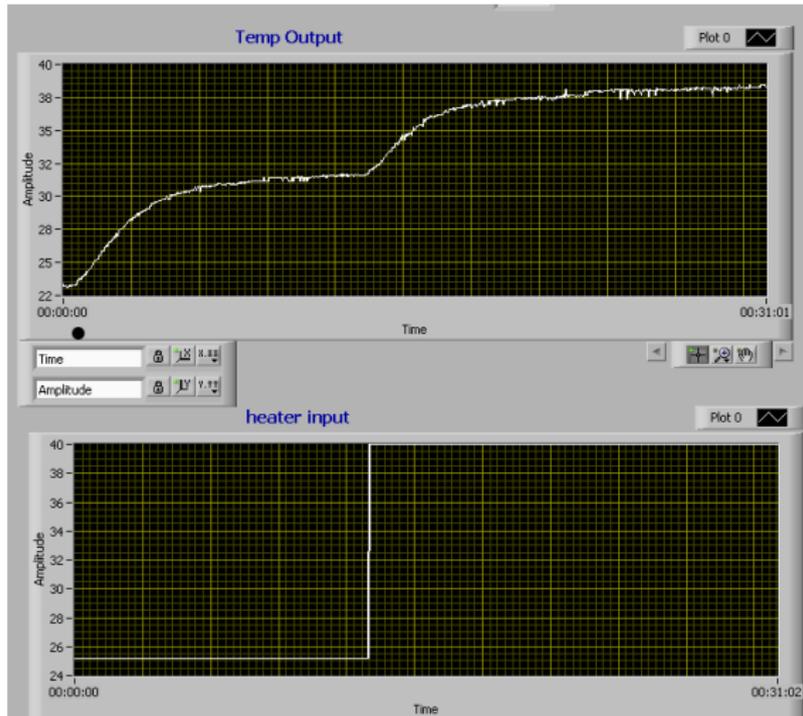
Required Response

- Peak Overshoot less than 15%.
- Settling time of ≈ 50 s.
- Steady state error not more than 5%.

Modelling

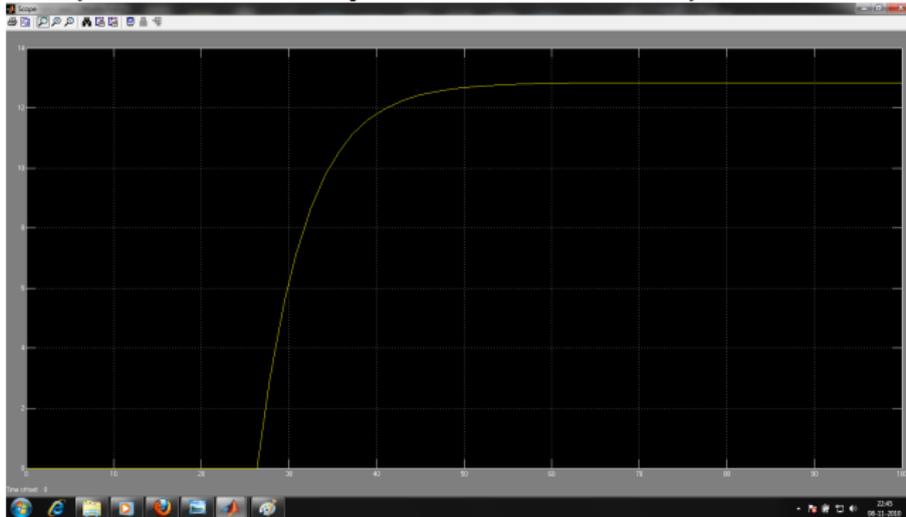
- System response was recorded for a step of 15 PMV.
- It was found that system behaviour was similar to a first order system.
- Also it differs for each operating point, we will be referring to 31.2 Deg.C.
- Further calculations gives gain $K = 0.4733$, time constant $\tau = 8.69\text{s}$ and transport lag $\tau_d = 1.34\text{s}$.

Plots



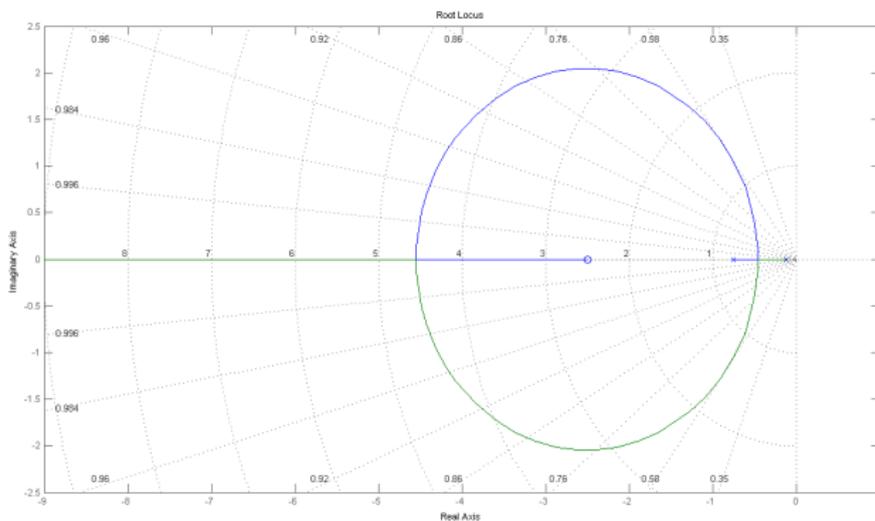
Unity Feedback

Response with Unity Feedback to a step of 15 units



Root Locus

Root locus was plotted with $K_p/K_d = .4$ and varying K_p



Calculations

Zeta can be calculated from peak overshoot:

$$\zeta = -\frac{\ln\left(\frac{15}{100}\right)}{\left(\pi^2 + \ln\left(\frac{15}{100}\right)^2\right)^{\frac{1}{2}}} = 0.449$$

From Settling time:

$$w_n = \frac{4}{\zeta t_s} = 0.178$$

Calculations

From the root locus plot we can get the K_p and K_d .