To specified the point n of max magnitude (for rise-time)

$$h(n) = \sum_{k=0}^{n} r_1^{k} r_2^{n-k}$$

$$r_1^0 r_2^n + r_1^1 r_2^{n-1} + r_1^2 r_2^{n-2} + \dots + r_1^n r_2^0 + r_1^{n+1} r_2^{-1} = h(n)$$

$$\frac{r_2}{r_1} h(n) = r_2 + \frac{r_2}{r_1^{n-1}} + \frac{r_2}{r_1^{n-2}}$$

$$\left(\frac{r_2}{r_1} - 1\right) h(n) = \frac{r_2^{n+1}}{r_1} - r_1^{n}$$

$$h(n) = \frac{\frac{r_2^{n+1}}{r_1} - r_1^{n}}{\frac{r_2}{r_1} - 1} = \frac{\frac{r_2^{n+1} - r_1^{n+1}}{r_1}}{\frac{r_2 - r_1}{r_1}}$$

$$= \frac{r_2^{n+1} - r_1^{n+1}}{r_2 - r_1}$$

$$h(n) - h(n-1) = \frac{r_2^{n+1} - r_1^{n+1}}{r_2 - r_1} - \frac{r_2^{n} - r_1^{n}}{r_2 - r_1} = 0$$

$$\frac{r_2^{n+1} - r_1^{n+1} - r_2^{n} + r_1^{n}}{r_2 - r_1} = \frac{r_2^{n}(r_2 - 1) + r_1^{n}(1 - r_1)}{r_2 - r_1} = 0$$

$$r_2^{n}(1 - r_2) = r_1^{n}(1 - r_1)$$

$$\left(\frac{r_2}{r_1}\right)^{n} = \left(\frac{1 - r_1}{1 - r_2}\right) \Rightarrow n \log\frac{r_2}{r_1} = \log\frac{1 - r_1}{1 - r_2}$$

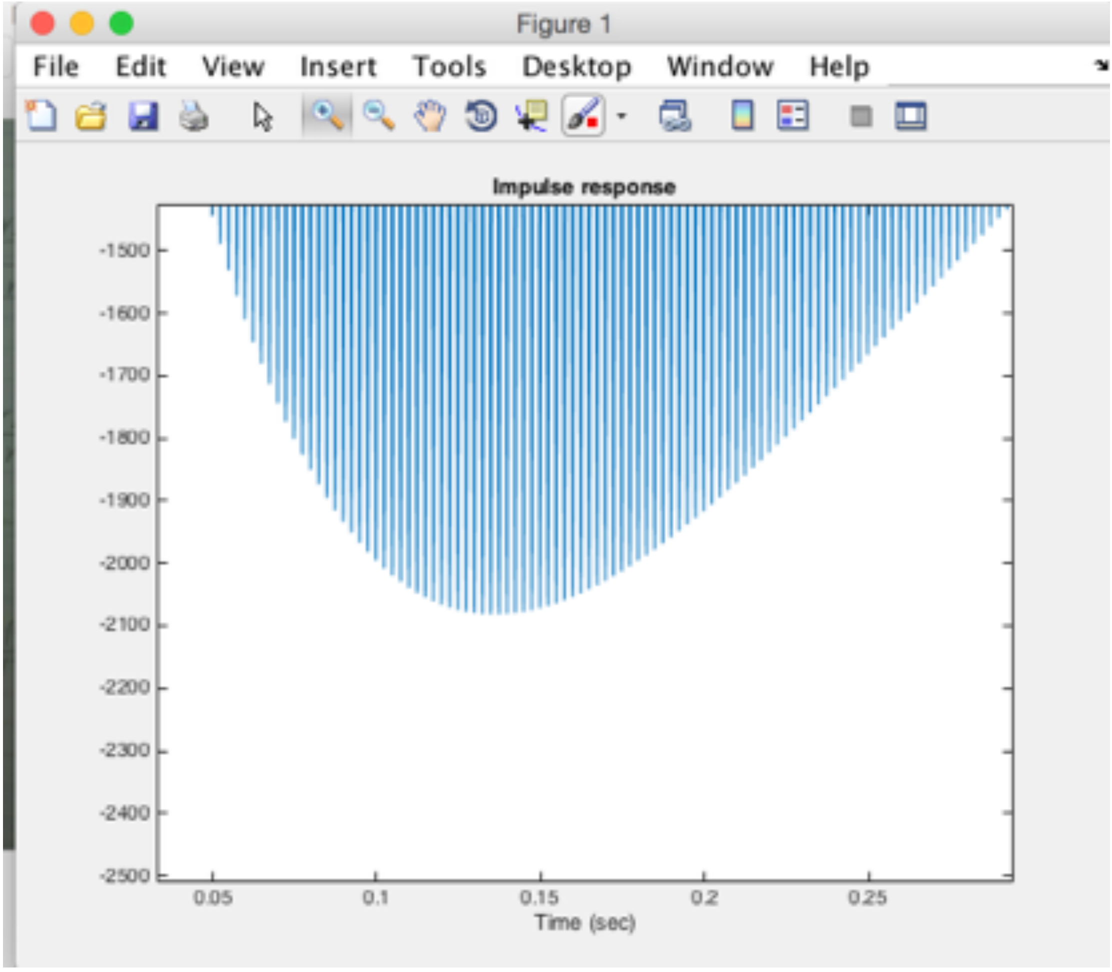
$$n = \frac{\log\frac{1 - r_1}{1 - r_2}}{\log\frac{r_2}{r_1}}$$

For the rising time:
I use the below equation to calculate the rising time:
rise time tr = n/Fs

set Ta = 0.5, Tb = 0.8, Fs = 8000
r1 = 0.01^(1/(Ta*Fs)) = 0.9988
r2 = 0.01^(1/(Ta*Fs)) = 0.9993

n = 1076.096
-> tr = 0.1345

```
peak = log((1-r1)/(1-r2))/log(r2/r1)/8000
```



for the falling time:
I just modified the value of the Ta, and then the falling time will increase when I add the value of the Ta.

Python implementation:

See the file Lab_2_4_10_phc307: