User Document

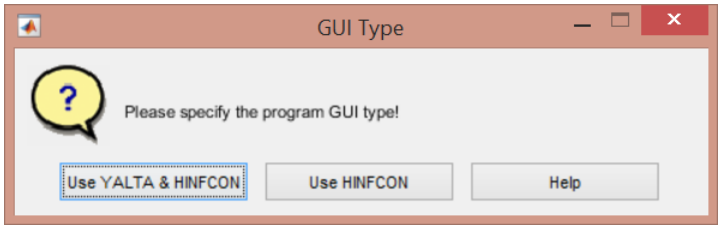
HINFCON combined with YALTA

This brief documents is intended to be a user guide for the Graphical User Interface which contains combination of MATLAB based programs HINFCON and YALTA. Detailed information about these programs can be found in corresponding user documents.

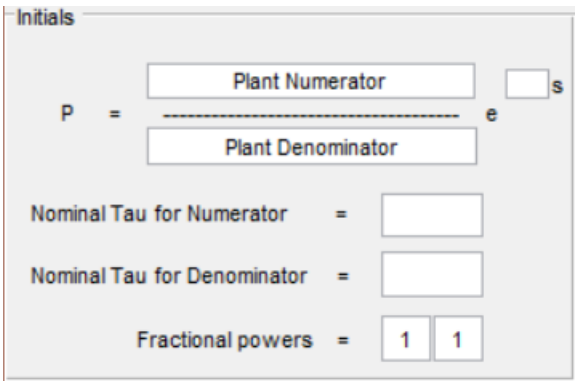
Contents

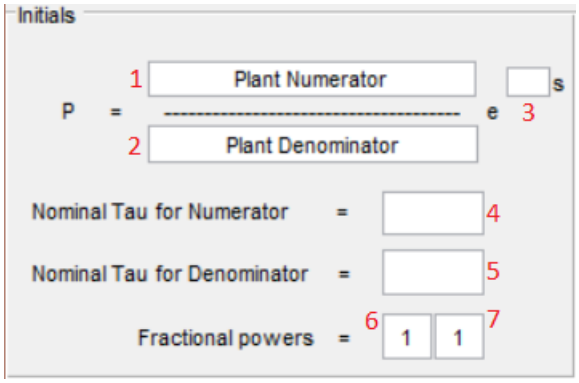
1 Graphical User Interface selection

At the very beginning of the program, user will be asked to specify the Graphical User Interface (GUI) type as shown below:



The only difference between two buttons is that the first button, "Use YALTA & HINFCON", provides calculation of M_n, M_d and N_0 (These parameters are explained well in [1]) from a defined retarded/neutral plant transfer function, while the second button assumes these parameters are already known by the user. From now on, the document will separate GUIs that are provided for each corresponding button as '1st GUI' and '2nd GUI'. The following figure shows the panel that is designed for definition of plant system in the 1st GUI:

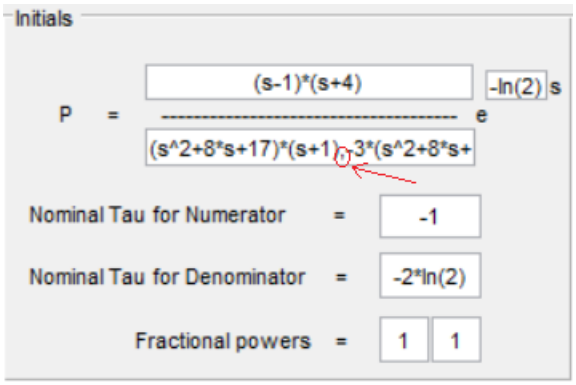


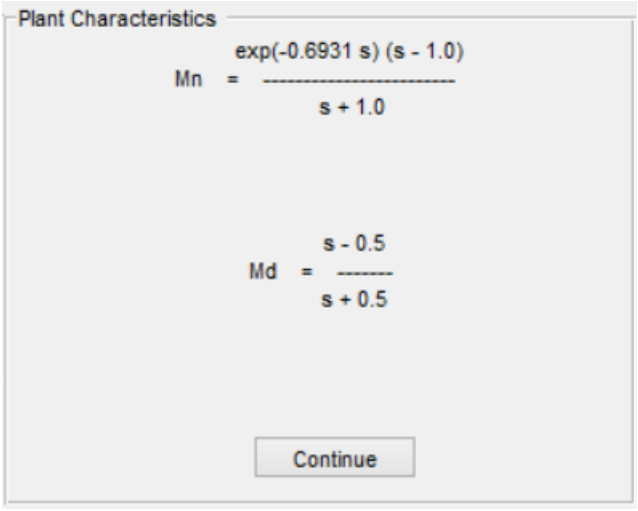


- 1st and 2nd fields are written in the same format, by separating terms in numerator/denominator according to their delays and their corresponding 'nominal tau values' entered in 4th and 5th fields, by using comma.
- 3rd field is provided for user to enter constant delay in plant, while 4th and 5th fields are used to obtain tau values for numerator and denominator respectively. Functions such as ln(x), log3(x) may be entered in these fields, but any coefficient must be written on the left side of the function: -2*ln(x).
- 6th and 7th fields are used to enter fractional power for numerator and denominator respectively. Fractional powers must be in [0,1] interval.

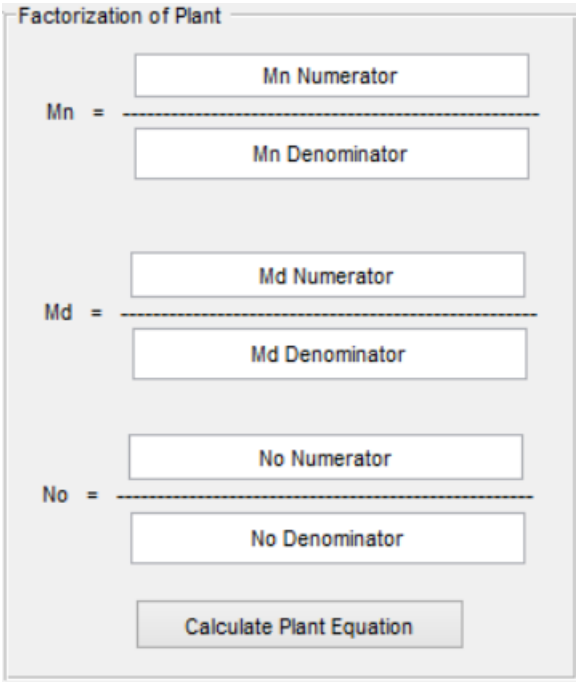
Let us observe usage of this panel in an example, since its usage is complicated because of input parameters of main function of YALTA.

Example| $P(s) = \frac{(s-1)(s+4)e^{-hs}}{(s^2+8s+17)(s+1-3e^{-2hs})}$ *where* $h = \ln(2)$



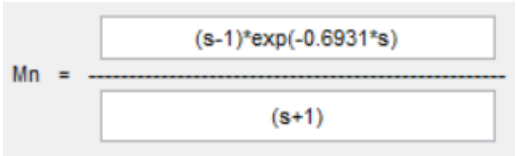


If the user already knows M_n, M_d & N_0, 2nd GUI provides the following panel, and estimates plant system for the user to double check entered information before continuing.



These fields need to be filled by using MATLAB syntax directly, different from 1st and 2nd fields described for the 1st GUI.

For example, if $M_n = \frac{(s-1)e^{-\ln(2)s}}{s+1}$ ➔



2 Understanding GUI Components

After factorization/estimation of plant, there will be 2 steps remaining: Calculation of optimal gamma and estimation of suboptimal controller. The program needs following inputs: W1, W2, frequency range, estimated gamma range and desired threshold value for null, additional to plant information.

Step 1: Calculation of γ_{opt}

As the user clicks calculate optimal gamma, gammaOpt.m runs and returns γ_{opt} with 9 precision, and draws gamma with respect to $X(\gamma) = 1 \pm F_{\gamma}\left(\frac{j}{\gamma}\right) M_n(\frac{j}{\gamma})$ in the desired range of gamma and selects the most rightest zero in this range.

Step 2: Estimation of C_{opt}

After γ_{opt} is identified, necessary calculations shown in [1] are made to estimate C_{opt}. Functions defined in the estimation process are shown on the rest of the GUI to inform the user about the estimation process. Moreover, as in the old versions of HINFCON, norm of ([W1.S W2.T]), bode plot for magnitude and phase components in defined frequency range and nyquist plot of $P(jw)C(jw)$ are provided at this step.

3 References

[1] H. Özbay, "H_{∞} Optimal Controller: Computational Issues" pp. 48-67