PID Controller Tuning

The Zeigler-Nichols methods is probably the easiest method to use for simple systems where you can allow your system to go unstable or oscillate a lot. An overview of the process is:

1) Set the Ki and Kd gains to zero.
2) Increase the proportional gain, which we will call **Ku**, until you see a stable oscillation at your output. It shouldn't be decaying or growing very much at all.
3) Capture data representing the time and position of the the motor.
4) Import this data into Excel or Matlab and measure the period of oscillation, which we will call **Tu**. Hint: generate your data with commas separating the values and a new line for each measurement and print in the Serial monitor, then copy into a comma-separated values (.CSV) text file, which can be imported directly into Excel or Matlab.
5) Use a Ziegler-Nichols table to determine the final **Kp**, **Ki**, and **Kd** as a function of Ku and Tu.

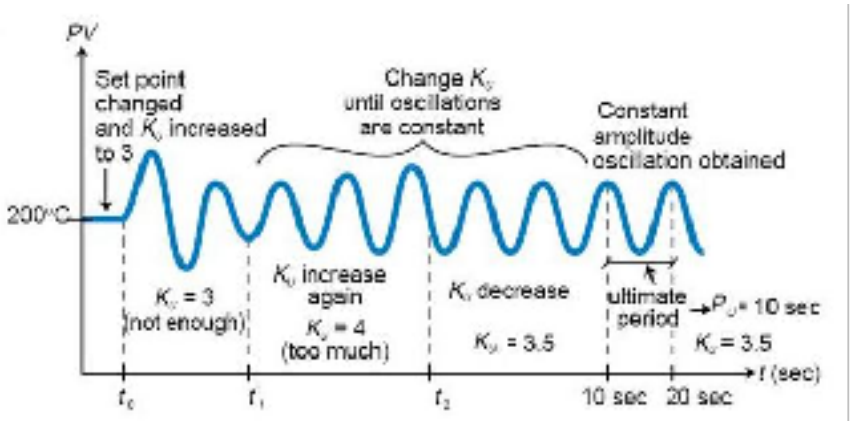

Image from: https://controls.engin.umich.edu/wiki/index.php/PIDTuningClassical#Ziegler-Nichols_Method

See https://en.wikipedia.org/wiki/Ziegler%E2%80%93Nichols_method and https://controls.engin.umich.edu/wiki/index.php/PIDTuningClassical#Ziegler-Nichols_Method for details and the tables.

Remember that this black-box approach takes into account any changes in the mass being rotated. ***So, make sure to have your sensor mount and sensors attached when doing the tuning (but don't have the wires plugged in yet in case it goes unstable).***

Use this table for deriving the gains from the values determined during the Ziegler-Nichols oscillation experiments

Control Type	K_p	K_i	K_d
P	$0.5K_u$	-	-
PI	$0.45K_u$	$1.2K_p / T_u$	-
PD	$0.8K_u$	-	$K_p T_u / 8$
PID	$0.6K_u$	$2K_p / T_u$	$K_p T_u / 8$