Other practical Note:

Tuning G_{FF} can start at

$\tau_{lead} \cong \tau_{LS} + \tau_v^*$

$\tau_{lag} \cong 0.1\,\tau_{lead}$

Feedforward-Feedback Architecture

Note: Disturbance feedforward architecture is almost always used with the output feedback, because

- We do not have a very precise model G_p of plant.
- Measurement errors (output disturbances)
- Errors in feedforward components
- Unmeasured load variables

$$C = \left[G_L + G_{LS} G_{FF} G_v^* G_p\right] \cdot L + G_p G_v^* G_c E$$

$$E = R - G_M C$$

$$\rightarrow C = \left[\frac{G_L + G_{LS} G_{FF} G_v^* G_p}{(1 + G_M G_c G_v^* G_p)}\right] \cdot L + \left[\frac{G_c G_v^* G_p}{(1 + G_M G_c G_v^* G_p)}\right] \cdot R$$

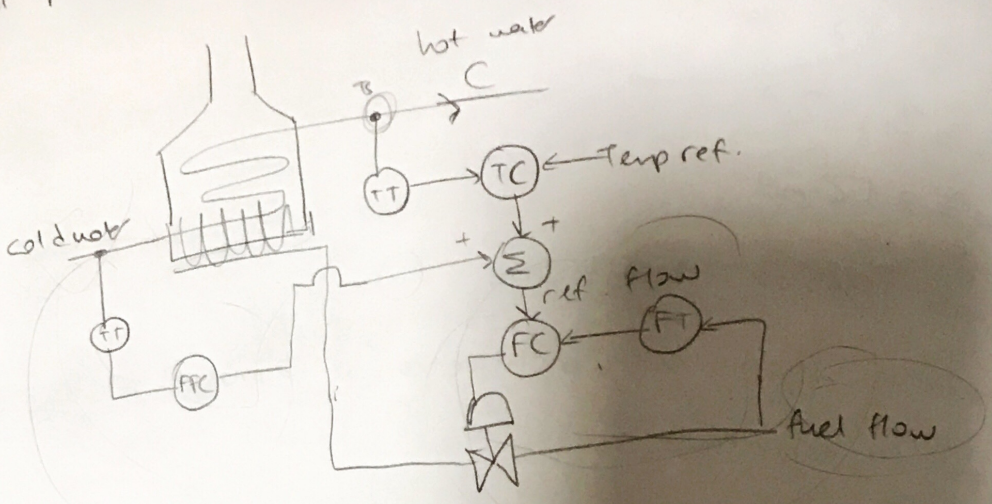
Small G_{FF} small effect of disturbance at output

⚠ Note that the denominator of both TFs are the same and they do not have a G_{FF} term.

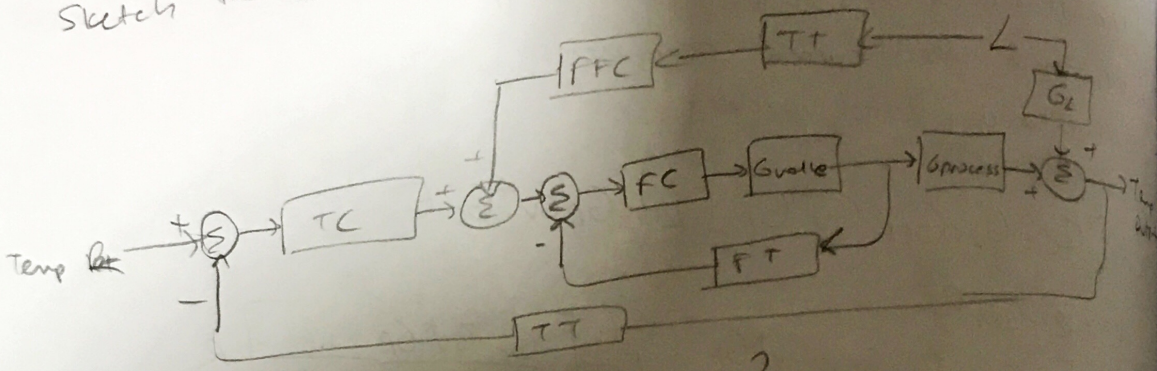
→ Design of G_{FF} does not effect the stability properties of the overall system.

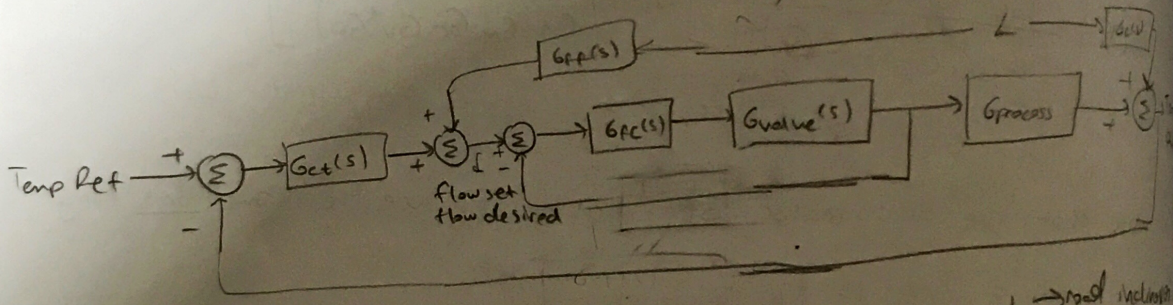
(Leaving us free to design it to achieve best disturbance rejection

All parts in the same

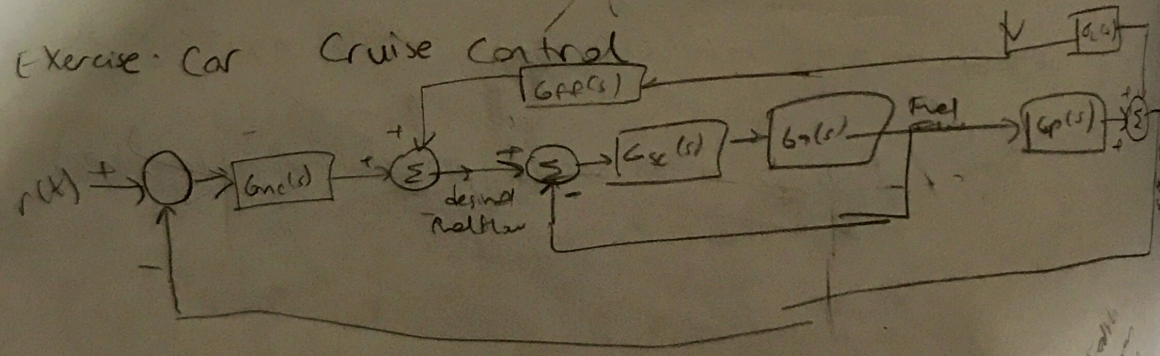


Sketch the Block diagram corresponding to the process





Exercise: Car Cruise Control



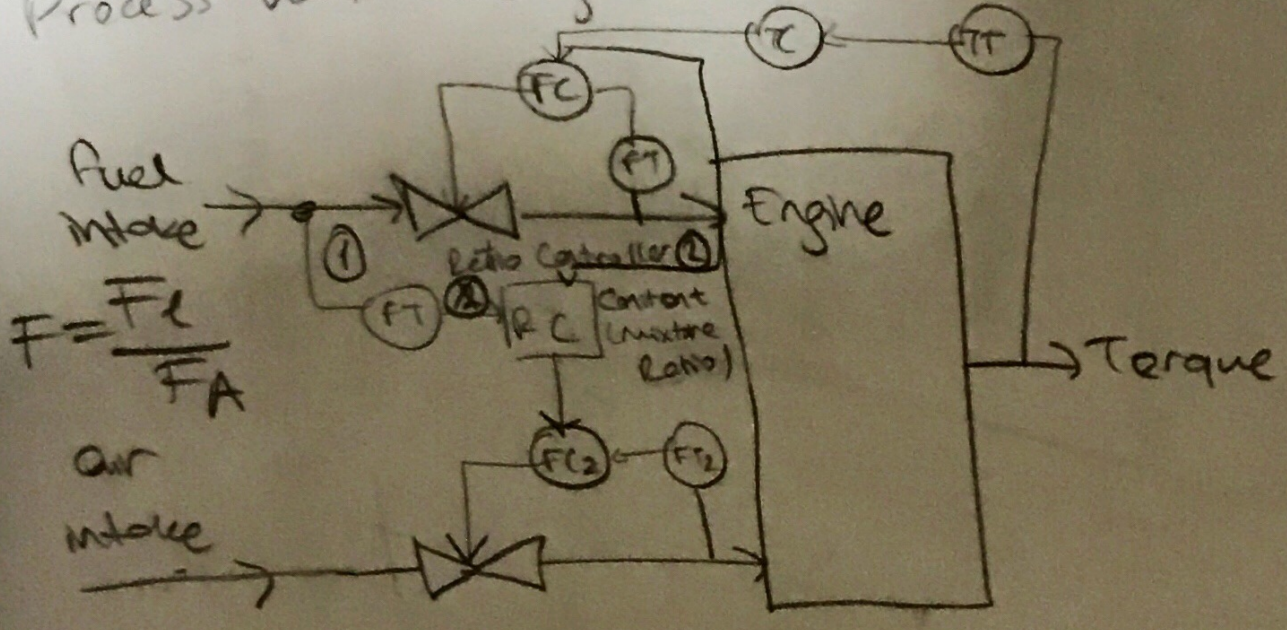
Example: Engine ECU Design

Task: Control fuel flow to maintain efficient burn (max power, minimum pollution)

Manipulated variable:

1) Fuel Flow
2) Air Flow

Process Variable: Engine Torque



$$F = \frac{F_f}{F_A}$$

"Ratio-Control"