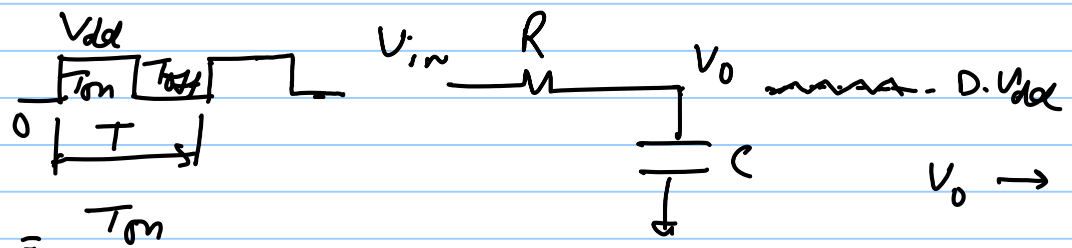
EE2019 Analog Systems & Lab

Note Title 2/18/2020

Pulse width Modulation

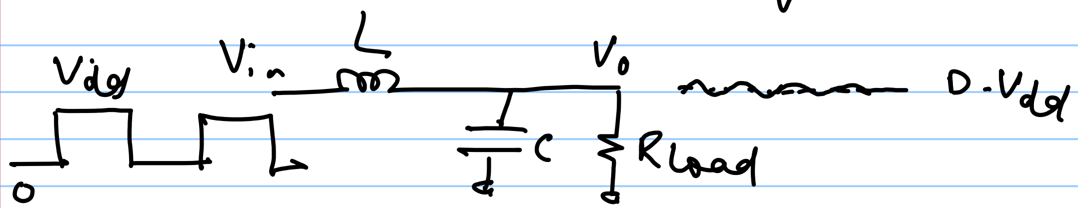


$D = \frac{T_{on}}{T}$

$V_0 \rightarrow$ average of V_{in} with small ripple.

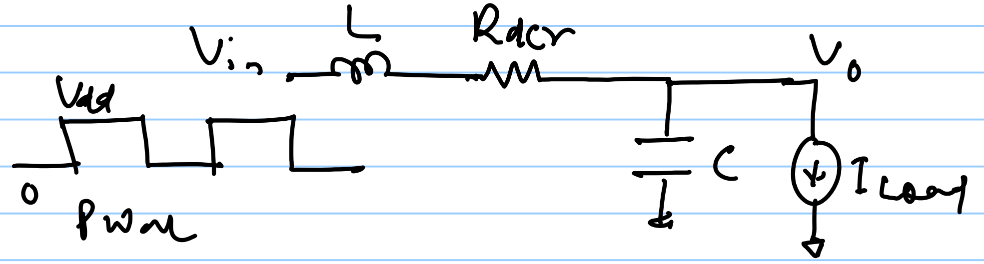
$RC >> T$

Since R can't drive any load so we replace R with L



L is lossless so no IR drop

In reality L is not lossless and has some resistance.



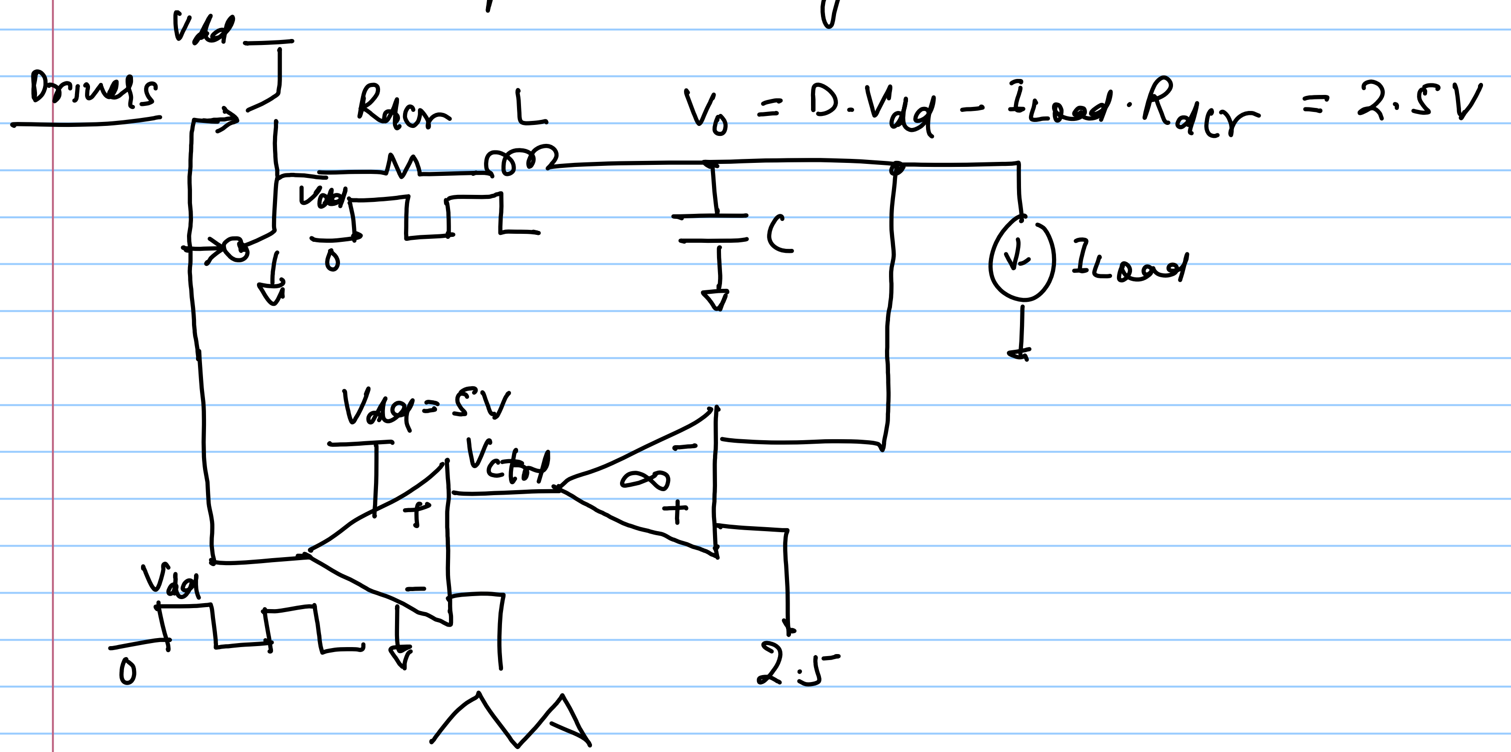
R_{dcr} → range of 10s of mΩ to 100mΩ

$$V_o = D \cdot V_{dd} - I_{Load} \cdot R_{dcr}$$

V_o can't remain constant for a fixed D

D must be varied in order to compensate for any change in V_o

We need to operate in negative feedback.



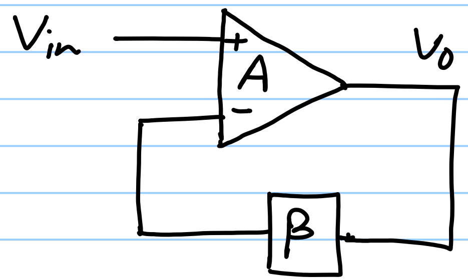
$V_o = D \cdot V_{dd} - I_{Load} \cdot R_{dcr} = 2.5V$

op-amp is replaced with op-amp RC integrator to stabilize the loop.

<u>Stability</u>

BIBO → Bounded input bounded input

o/p Signal must converge to a finite value for a finite input



$$\frac{V_0}{V_{in}} = \frac{A}{1+A\beta}$$

if $A\beta = -1$

$\frac{V_0}{V_{in}} \to \infty$ unstable.

$\angle A\beta = 180^\circ$

$|A\beta| = 1$

total phase shift in a negative feedback systems = 180°

if $A\beta$ has addional phase shift of 180°

Total phase shift of feedback loop = 360°

$180^\circ \rightarrow$ -ve (negative feedback)

$360^\circ \rightarrow$ +ve (positive feedback)