$$= \frac{k_p \omega_n^2 (1+T_d s)}{s(s+2\xi\omega_n) + k_p\omega_n^2(1+T_d s)} \Rightarrow \frac{k_p \omega_n^2 (1+T_d s)}{s^2 + 2\xi\omega_n s + k_p\omega_n^2 + k_p\omega_n^2 T_d s}$$

$$\therefore k_d = k_p T_d$$

$$= \frac{k_p \omega_n^2 (1+T_d s)}{s^2 + (2\xi\omega_n + k_p\omega_n^2 T_d) s + k_p\omega_n^2} = \frac{\omega_n^2 (k_p + k_d s)}{s^2 + (2\xi\omega_n + k_d\omega_n^2) s + k_p\omega_n^2}$$

* It is observed that the PD controller introduces a zero in the system & increases the damping ratio. The addition of zero may increase peak overshoot & reduce the rise time. But the effect of increased damping reduces the peak overshoot. PD controller doesnot modify the type number of the system. Hence PD controller willnot act modify steady state error.

Effect of PID - controller :-

* Three Basic Modes : Proportional, Integral and derivative (PID) can improve all aspects of the system performance.

* The proportional controller stabilizes the gain but produces a steady state error. The integral controller reduces or eliminates the steady state error. The derivative controller reduces the rate of change of error. The combined effect of all the three cannot be judged from the parameters k_p, k_i and k_d.