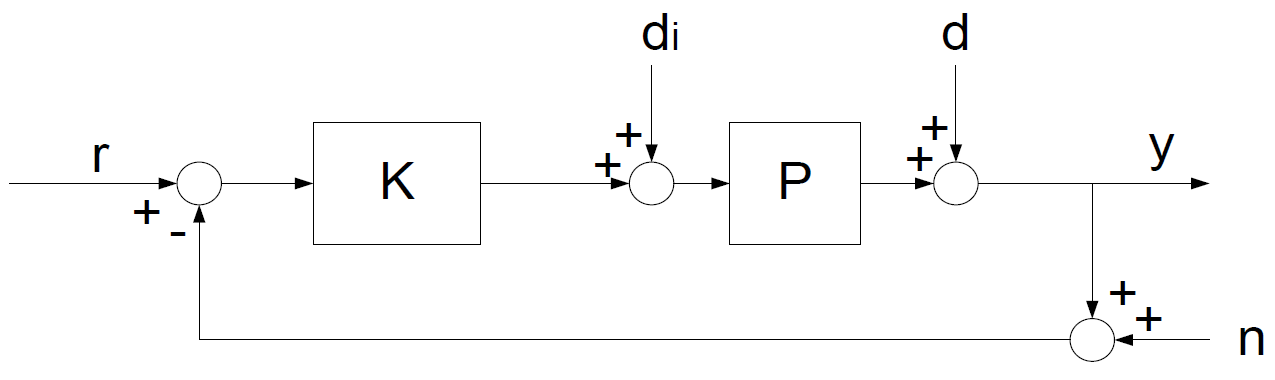
**Q**:

A classical feedback configuration is shown in below figure, in which P is plant, K is controller, r is command, n is sensor nose, di is plant input disturbance and d is plant output disturbance, respectively.

* Find the transfer functions between y and r, di and y, d and y and n and y, respectively (y is output).
* Explain why a bigger K leads to better robustness against the input and output disturbances (di and d), but worse robustness again (n) using the relationships described by the transfer functions.



**A**: The transfer functions are calculated as follows:

1. For the transfer function between y and r:

Since

Thus

1. For the transfer function between y and di:

Since

Thus

1. For the transfer function between y and d:

Since

Thus

1. For the transfer function between y and n:

Since

Thus