SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 35

Department of Electrical & Electronics Engineering

GENERALIZED ERROR SERIES

DYNAMIC ERROR COEFFICIENTS

- The steady state error obtained through the static error coefficients is either zero, a finite nonzero value, or infinity.
- Thus, the variation of the error with time can not be obtained through the use of such coefficients.
- The dynamic error coefficients presented below provide some information about how the error varies with time, namely, whether or not the steady state error of the system with a given input increases in proportion to t, t^2…

DYNAMIC ERROR COEFFICIENTS

- For the steady-state error, the static error coefficients gives the limited information. The error function is given by

$$\frac{E(s)}{R(s)} = \frac{1}{1+G(s)H(s)} \quad ---(1)$$

- For unity feedback system

$$\frac{E(s)}{R(s)} = \frac{1}{1+G(s)} \quad ---(2)$$

- The eqn.(2) can be expressed in polynomial form (ascending power of ‘s’)

DYNAMIC ERROR COEFFICIENTS

$$\frac{E(s)}{R(s)} = \frac{1}{K_1} + \frac{1}{K_2}s + \frac{1}{K_3}s^2 + \ldots\ldots\ldots ------(3)$$

Or, $$E(s) = \frac{1}{K_1}R(s) + \frac{1}{K_2}sR(s) + \frac{1}{K_3}s^2R(s)\ldots\ldots ----(4)$$

Take inverse Laplace of eqn.(4), the error is given by

$$e(t) = \frac{1}{K_1}r(t) + \frac{1}{K_2}\dot{r}(t) + \frac{1}{K_3}\ddot{r}(t) + \ldots\ldots ------(5)$$

Steady state error is given by

$$e_{ss} = \lim_{s\to 0} sE(s)$$

Let $$R(s) = \frac{1}{s}$$

DYNAMIC ERROR COEFFICIENTS

$$e_{ss} = \lim_{s \to 0} s.\left[\frac{1}{K_1}.\frac{1}{s} + \frac{1}{K_2}.s.\frac{1}{s} + \frac{1}{K_3}s^2.\frac{1}{s} + ...\right]$$

$$e_{ss} = \frac{1}{K_1}$$

Similarly, for other test signal we can find steady state error.

$K_1, K_2, K_3.....$ are known as "Dynamic error coefficients"