

Types of Systems

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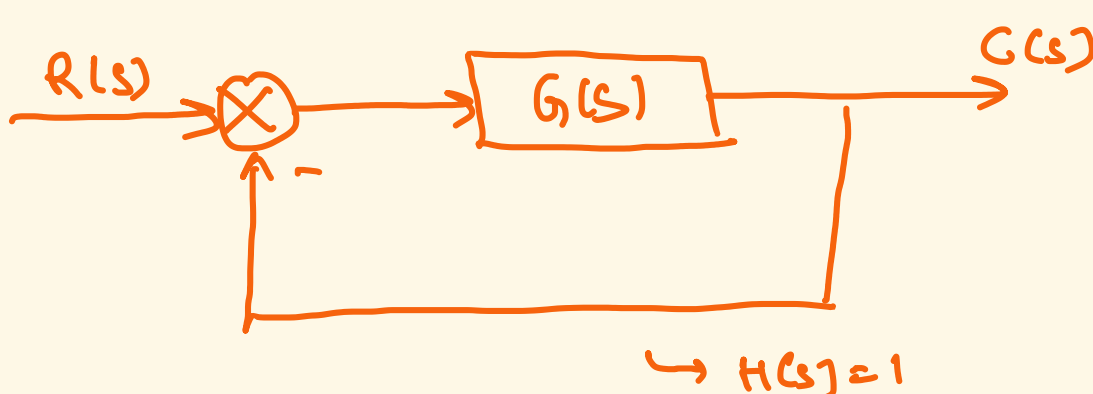
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1. Introduction :-

- The **Type** of system is defined as the number of poles of the system present at origin.
- It is defined for open loop Transfer function (OLTF) $G(s) \cdot H(s)$.
- It is not defined for closed loop Transfer function.
- The system should be a **Negative Unity feedback** system.

In negative feedback system, the value of feedback gain $H(s)$ is one. $\therefore H(s) = 1$



So, OLTF = $G(s)$

So, now we can say that "The Type of the System" is the number of poles of the OLTF $[=G(s)]$ present at the origin.

2. Type 0 system :-

The system whose OLTF has no pole at origin is a Type 0 system.

Example: If $G(s) \cdot H(s) = \frac{s+2}{(s+3)(s+4)}$

Solution: Poles of system: $s = -3, -4$

There are two poles at -3 and -4 but there is no pole at origin. Therefore, the system is Type-0 system.

3. Type 1 System:

The system whose OLTF has 1 pole at origin is a Type-1 system.

Example: $G(s) \cdot H(s) = \frac{s+2}{s(s+3)(s+4)}$

Even though we know that OLTF for Negative Unity feedback system is $G(s)$. But sometimes we represent as $G(s) \cdot H(s)$ where $H(s) = 1$

↳ it has only 1 pole at origin

4. Type-2 System :-

The system whose OLTF has 2 poles at origin is a Type-2 system.

Example: $G(s) \cdot H(s) = \frac{s+2}{s^2(s+1)(s+2)}$

↳ has total 4 poles out of which only 2 poles are present at origin

BONUS: Type-n system

↳ System whose OLTF has n-poles at origin.

5. Example: Determine the Type and the Order of the following system:

OLTF	TYPE	ORDER
1. $G(s) \cdot H(s) = \frac{1}{s+1}$	0	1
2. $G(s) \cdot H(s) = \frac{1}{s^2+s+1}$ ↳ no pole at origin i.e. $s=0$ is not the solution of this polynomial	0	2
3. $G(s) \cdot H(s) = \frac{1}{s(s+1)(s+2)}$	1	3
4. $G(s) \cdot H(s) = \frac{s+1}{s^2(s+4)}$	2	3
5. $G(s) \cdot H(s) = \frac{\cancel{s}}{\cancel{s}(s^2+4)} = \frac{1}{s^2+4}$	0	2

6. References:

↳ Neso Academy

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