SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EEB301/ CONTROL SYSTEMS

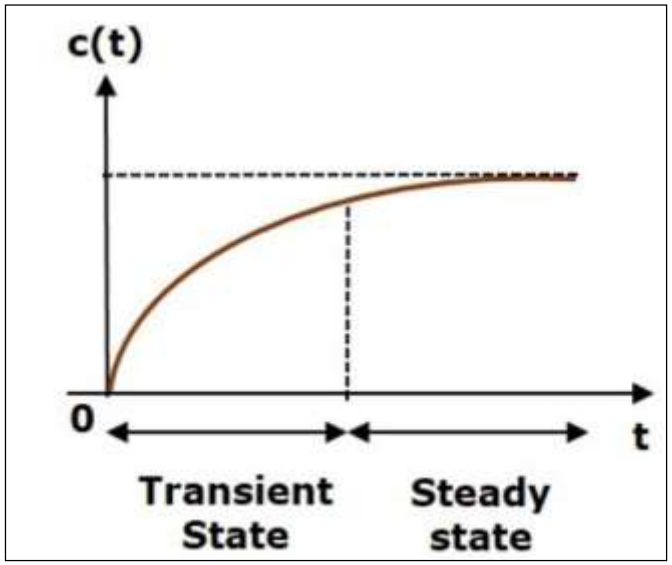
III YEAR / V SEMESTER

Unit II – TIME RESPONSE

Topic : Time Response

Time Response

- If the output of control system for an input varies with respect to time, then it is called the time response of the control system.



- Mathematically, we can write the time response c(t) as

$$c(t)=ctr(t)+css(t)$$

where,

- ctr(t) is the transient response
- css(t) is the steady state response

Transient & Steady state Response

Transient Response

- After applying input to the control system, output takes certain time to reach steady state.
- the output will be in transient state till it goes to a steady state.
- Therefore, the response of the control system during the transient state is known as transient response.
- The transient response will be zero for large values of ‘t’. Ideally, this value of ‘t’ is infinity and practically, it is five times constant.

$$\lim_{t\to\infty} c_{tr}(t) = 0$$

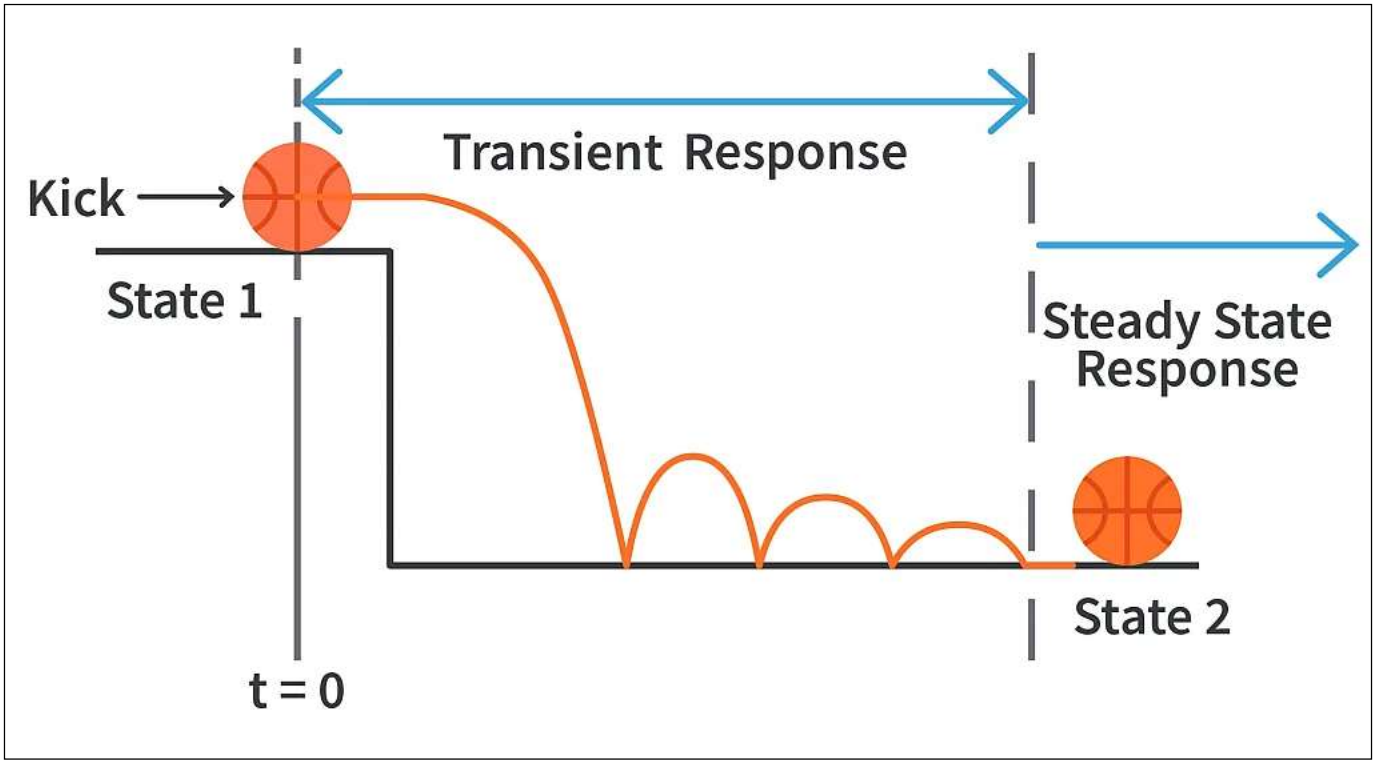
Steady state Response

- The part of the time response that remains even after the transient response has zero value for large values of ‘t’ is known as steady state response.
- the transient response will be zero even during the steady state.

Transient & Steady state Response

Example:

- When we kick a ball in a set up as shown, the ball bounces a few times due to its kinetic energy and then settles. The response when the ball is still bouncing is the transient response and once it settles, it's the steady state.the output will be in transient state till it goes to a steady state.



Order of the System

- Order of a system is given by the order of the differential equation governing the system.
- In the transfer function, the maximum power of s in the denominator polynomial gives the order of the system.

FIRST ORDER SYSTEM

- A first order control system is defined input-output relationship (also known as a transfer function) is a first- order differential equation.
- The order of a differential equation is the order of the highest order derivative present in the equation.

SECOND-ORDER SYSTEM

- Order of a control system is determined by the power of ‘s’ in the denominator of its transfer function.
- If the power of s in the denominator of the transfer function of a control system is 2, then the system is said to be second order .

Thank You