Forstærkerteknik og fejlberegning

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1 Linear Time Invariant Systems

Linear Map
The map $f : R^n - > R^m$ is said to be linear if for any $x, y \epsilon R^n$ and $\alpha \epsilon R$, the following conditions hold

$$f(x+y) = f(x) + f(y) \qquad \text{Super position}$$
$$f(ax) = \alpha f(x) \qquad \text{Homogeneity}$$

The function has to go through (0,0) in 2D for it to be linear due to homogeneity.

Time-Invariant System
and any delay $\tau \epsilon R$ the following relation holds:

$$y(t-\tau) = \sigma(t, u(t-\tau))$$

for all times $t \epsilon R$, where y denotes the output signal of the system.

The importance is that the system does not change its behavior due to time. This can be seen as a canon firing at 8am it will not fire different compared to if you do the same at 5pm.

1.1 Time-Domain models

Two types of linear time-domain models.
Continous-time state space models (based on differential equations)

$$\dot{x} = Ax + Bu$$

$$y = Cx + Du$$

- x = state
- u = input
- y = output
- A = system matrix
- B = input matrix
- C = output matrix
- D = Direct feedtrhough matrix

Discrete-time state space models (based on difference equations)

$$x_{k+1} = \Sigma x_k + \Gamma u_k$$

$$y_k = Cx_k + Du_k$$

1.2 Examples