We have introduced random processes. We can have

- discrete rp $X_1, X_2, \ldots$
  - The process is called X_n, but X_n might also refer to the nth random variable in the sequence, depending on context

or

- continuous rp $X(t)$ for $t \in (-\infty, \infty)$ or $t \in [0, \infty)$

How do we characterize the probabilistic behavior of a rp?

If it is not known whether the process is continuous- or discrete-time call it $X(t)$.

Often use first- and secondorder moments of a rp:

Defn. The <u>mean function</u> of a rp $X(t)$ is

$$\mu_X(t) = E[X(t)] \quad \text{for every } t$$

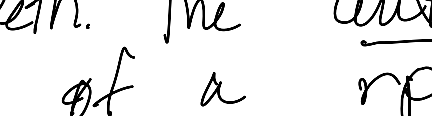
This can be written as

$$\mu_X(t) = \int_{-\infty}^{\infty} x f_{X(t)}(x)\,dx$$

where $f_{X(t)}$ is the pdf of the rv $X(t)$

Defn. The <u>autocorrelation function</u> of a rp $X(t)$ is

$$R_{XX}(t_1, t_2) = \underbrace{E[X(t_1)\,X(t_2)]}_{\text{correlation of two rvs } X(t_1),\ X(t_2)}$$



Defn. The <u>autocovariance function</u> of a rp $X(t)$ is

$$C_{XX}(t_1, t_2) = E\underbrace{[(X(t_1) - \mu_X(t_1))(X(t_2) - \mu_X(t_2))]}_{\text{covariance of rvs } X(t_1),\, X(t_2)}$$