Session 2: Time and Frequency Domain Representations

# Objectives:

- Understand the difference between continuous and discrete-time signals.  
- Analyze periodicity and symmetry in signals.  
- Learn practical Octave plotting of sine, cosine, and exponential signals.  
- Understand time-domain manipulation: time-shifting and time-scaling.

# Topics:

## A. Continuous vs Discrete-Time Signals

• Continuous-time: Defined for all time values (e.g., x(t) = cos(2πt))

• Discrete-time: Defined at integer time steps (e.g., x[n] = cos(2πn/N))

## B. Periodicity

• A signal x[n] is periodic if x[n] = x[n+N] for all n.

• Sine and cosine signals are periodic.

## C. Symmetry

• Even signals: x[n] = x[-n]

• Odd signals: x[n] = -x[-n]

• Any signal: x\_even[n] = ½(x[n] + x[-n]), x\_odd[n] = ½(x[n] - x[-n])

## D. Signal Manipulation

• Time-shifting: x[n-n0]

• Time-scaling: x[an] (e.g., downsampling/upsampling)