EEE 4106 Signals and Communication I.

Prof. Ciira Maina
ciira.maina@dkut.ac.ke

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Operations on signals

- Amplitude scaling: Form the signal $y(t) = \alpha x(t)$
- Addition, Subtraction $x_3(t) = x_1(t) \pm x_2(t)$
- Multiplication $x_3(t) = x_1(t)x_2(t)$

Examples

- Sketch the following signals
  - $2u(t)$
  - $2r(t)$
  - $u(t) - r(t)$
  - $e^{-t}u(t)$
  - $\cos(2\pi t + \frac{\pi}{2})$
  - $e^{-t}\sin(4\pi t + \frac{\pi}{2})$

Operations on Signals

- Time scaling $y(t) = x(at)$ where $a > 0$
  - If $a > 1$ the signal is compressed
  - If $0 < a < 1$ the signal is expanded

Operations on signals

- Delay (time shifting): a delayed version of a signal $x(t)$ is given by $x'(t) = x(t - D)$ where D is a real number. If $D > 0$ the we have a delay. If $D < 0$ we advance.
- Sketch $u(t - 1)$
- Sketch $u(t) - u(t - 1)$
- Sketch $r(t) - r(t - 2)$

Operations on signals

- Time reversal (reflection): the time reversed version of a signal $x(t)$ is given by $x'(t) = x(-t)$
- Sketch $r(-t)$
- Sketch $u(-t+2)$

Systems

- Systems perform operations on signals
- Often we are concerned with the input-output relationship of systems

Systems - Introduction

- Most systems we encounter are realised as electrical circuits.
- Consider for example the RC circuit, if we assume the output is the voltage across the capacitor we can determine this by applying techniques from circuit theory.