ELL205 Signals and Systems

Tutorial 1, 31 July - 4 August 2023

1) Problems 1.3,1.6, 1.9-1.11 of the textbook. Answers to these are available in the textbook itself. DO try to work out before the tutorial class and discuss in case you have questions.
2) Problems 1.25,1.26, 1.32,1.33,1.35,1.36 of the textbook can be attempted in the tutorial class.

- $\mathcal{EV}\{x(t)\} = \frac{1}{2}(x(t) + x(-t))$. For complex signals, we refer to the conjugate symmetric part as $x_{cs}(t) = \frac{1}{2}(x(t) + x^*(-t))$. $\mathcal{OD}\{x(t)\} = \frac{1}{2}(x(t) - x(-t))$. For complex signals, we refer to the conjugate anti-symmetric part as $x_{cas}(t) = \frac{1}{2}(x(t) - x^*(-t))$. Every signal can be written as the sum of its conjugate symmetric (even if real) and conjugate anti-symmetric part (odd if real) so that $x(t) = x_{cs}(t) + x_{cas}(t)$.
- $u(t)$ is the unit step function - $u(t) = 1$ for $t > 0$ and 0 for $t < 0$ (undefined for $t = 0$).
- $x[n] = \cos\left(\frac{\pi}{8}n^2\right)$ in Problem 1.26 c) is the discrete-time (linear) chirp signal. It finds a lot of application in communications. The continuous-time (see https://en.wikipedia.org/wiki/Chirp) linear chirp finds innumerable applications. It is used in radars for example. It is given by $x(t) = \sin\left(\phi_o + 2\pi\left(\frac{c}{2}t^2 + f_0 t\right)\right)$. What is the instantaneous frequency? Is the continuous-time chirp periodic?