$$x[n] = 3 + 2e^{j0.2\pi n} + 2e^{-j0.2\pi n} - 7je^{j0.7\pi n} + 7je^{-j0.7\pi n}$$

$$\overset{\curvearrowleft}{7e^{-j\pi/2}} \qquad \overset{\curvearrowleft}{7e^{j\pi/2}}$$

(a)

$$\hat{\omega} = -0.2\pi \quad \text{is same as} \quad \hat{\omega} = 2\pi - 0.2\pi = 1.8\pi$$

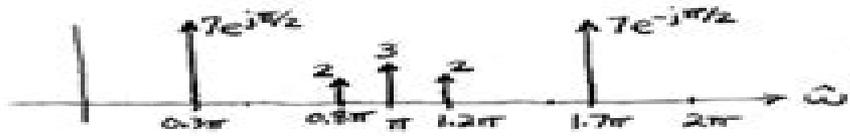$$\hat{\omega} = -0.7\pi \longrightarrow \hat{\omega} = 2\pi - 0.7\pi = 1.3\pi$$

SPECTRUM of x[n]

(b) $x_b[n] = x[n]e^{j0.4\pi n}$

All frequencies will be increased by 0.4π

$$0 \rightarrow 0.4\pi \qquad 0.7\pi \rightarrow 1.1\pi \qquad 1.8\pi \rightarrow 2.2\pi$$

$$0.2\pi \rightarrow 0.6\pi \qquad 1.3\pi \rightarrow 1.7\pi \qquad = 2.2\pi - 2\pi = 0.2\pi$$

SPECTRUM of $x_b[n]$

(c) $(-1)^n = e^{j\pi n}$, so all frequencies increase by π.

$$0 \rightarrow \pi \qquad 0.7\pi \rightarrow 1.7\pi \qquad 1.8\pi \rightarrow 2.8\pi \rightarrow 0.8\pi$$

$$0.2\pi \rightarrow 1.2\pi \qquad 1.3\pi \rightarrow 2.3\pi = 2.3\pi - 2\pi = 0.3\pi$$

SPECTRUM of $x_c[n]$

Signal Processing First Solution Chapter 13

Steven A. Tretter

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   Discrete Communication Systems Stevan Berber,2021-07-19 This is the first textbook which presents the theory of pure discrete communication systems and its relation to the existing theory of digital and analog communications at a graduate level Based on the orthogonality principles and theory of discrete time stochastic processes a generic structure of communication systems based on correlation demodulation and optimum detection is developed and presented in the form of mathematical operators with precisely defined inputs and outputs and related functions Based on this generic structure the traditionally defined phase shift keying PSK frequency shift keying FSK quadrature amplitude modulation QAM orthogonal frequency division multiplexing OFDM and code division multiple access CDMA systems are deduced as its special cases The main chapters presenting the theory of communications are supported by a set of supplementary chapters containing the theory of deterministic and stochastic signal processing which makes the book a self contained presentation of the subject The book uses unified notation and unified terminology which allows a clear distinction between deterministic and stochastic signals power signals and energy signals discrete time signals and processes and continuous time signals and processes and an easy way of understanding the differences in defining the correlation functions power and energy spectral densities and amplitudes and power spectra of the mentioned signals and processes In addition to solved examples in the text about 300 solved problems are available to readers in the supplementary material that aim to enhance the understanding of the theory in the text In addition five research Projects are added to be used by lecturers or instructors that aim to enhance the understanding of theory and to establish its relation to the practice   **Smart Grid as a Solution for Renewable and Efficient Energy** Ahmad, Ayaz,Hassan, Naveed Ul,2016-04-20 As the need for proficient power resources continues to grow it is becoming increasingly important to implement new strategies and technologies in energy distribution to meet consumption needs The employment of smart grid networks assists in the efficient allocation of energy resources Smart Grid as a Solution for Renewable and Efficient Energy features emergent research and trends in energy consumption and management as well as communication techniques utilized to monitor power transmission and usage Emphasizing developments and challenges occurring in the field this book is a critical resource for researchers and students concerned with signal processing power demand management energy storage procedures and control techniques within smart grid networks   *Optimizing and Measuring Smart Grid Operation and Control* Recioui, Abdelmadjid,Bentarzi, Hamid,2020-11-13 Smart grid SG also called intelligent grid is a modern improvement of the traditional power grid that will revolutionize the way electricity is produced delivered and consumed Studying key concepts such as advanced metering infrastructure distribution management systems and energy management systems will support the design of a cost effective reliable and efficient supply system and will create a real time bidirectional communication means and information exchange between the consumer and the grid operator of electric power Optimizing and Measuring Smart Grid Operation and Control is a critical

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