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Name: Mba Jonah Abai
Matric Number: 17/mhs01/287
Department: Computer Engineering
EEE 471

Assignment

1. Explain briefly the signal processing and interfacing techniques in measuring instruments
2. Explain briefly the effect system instrumentation

Solution

1. Signal Processing is concerned with improving the quality of the reading or signal at the output of a measurement system and one particular aim is also to attempt any noise in the measurement signal that has not been eliminated by careful design of the measurement system.

Signal interfacing this is a process of linking two or more devices together in other making them work as a functional unit i.e working together to produce an output.

Also signal processing is an electrical engineering subfield that focus on analyzing, modifying and synthesizing signal such as images, sound and scientific measurements. Signal processing techniques can be used to improve transmission, storage efficiency and subjective quality and to also emphasize or detect components of interest in a measured signal.

Hence, signal processing and signal interfacing work together to produce more precise and accurate results and improve the quantity of outputs. Various techniques associated with signal processing includes

- Statistical signal processing: this is an approach which treats signals as stochastic process, utilizing their statistical properties to perform signal processing tasks. Statistical techniques are widely used in signal

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processing applications. For example, one can model the probability distribution of noise incurred when photographing an image and construct techniques based on this model to reduce the noise in the resulting image.

Digital signal processing: this is the processing of digitized discrete-time sampled signals. Processing is done by general-purpose computers or by digital circuits such as ASICs, field-programmable gate arrays or specialized digital signal processors (DSP chips). Typical arithmetical operations include fixed-point and floating-point, real-valued and complex-valued, multiplication and addition.

Nonlinear signal processing: this involves the analysis and processing of signals produced from nonlinear systems and can be in the time, frequency, or spatio-temporal domains. Nonlinear systems can produce highly complex behaviors including bifurcations, chaos, harmonics and subharmonics which cannot be produced or analyzed using linear methods.

Discrete-time signal processing: this is for sampled signals, defined only at discrete only of discrete points in time, and as such are quantized in time, but not in magnitude. Analog discrete-time signal processing is technology based on electronic devices such as sample and hold circuits, analog time-division multiplexers, analog delay lines and analog feedback shift registers.

Continuous-time signal processing: this is for signals that vary with the change of continuous domain (without considering some individual interrupted points). The methods of signal processing include time domain, frequency domain, and complex frequency domain.

Analog signal processing: this is for signals that have not been digitized as in most 20th century radio, telephone, radar and television systems. This involves linear electronic circuits as well as nonlinear ones. The former are for instance passive filters, active filters, additive mixers, integrators, and delay lines.

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2. Expert Systems: This is a term that refers to systems capable of mimicking human like decision making thus leading to the term AI (Artificial Intelligence). The architecture of an expert system is an example of a knowledge-based system. Expert systems were the first commercial systems to use a knowledge-based architecture. A knowledge-based system is essentially composed of two sub-systems: the knowledge base and the interface engine. In the field of artificial intelligence, inference engine is a component of the system that applies logical rules to the knowledge base to deduce new information while knowledge base (KB) is a technology used to store complex structured and unstructured information used by computer system.

Advantages

- Used to specify the rules in a format that was easily understood, reviewed and even edited by domain experts rather than IT experts

Disadvantages

- In the academic literature is the knowledge acquisition problem.