STATISTICAL TIME DIVISION MULTIPLEXING ARCHITECTURES AND DESIGN

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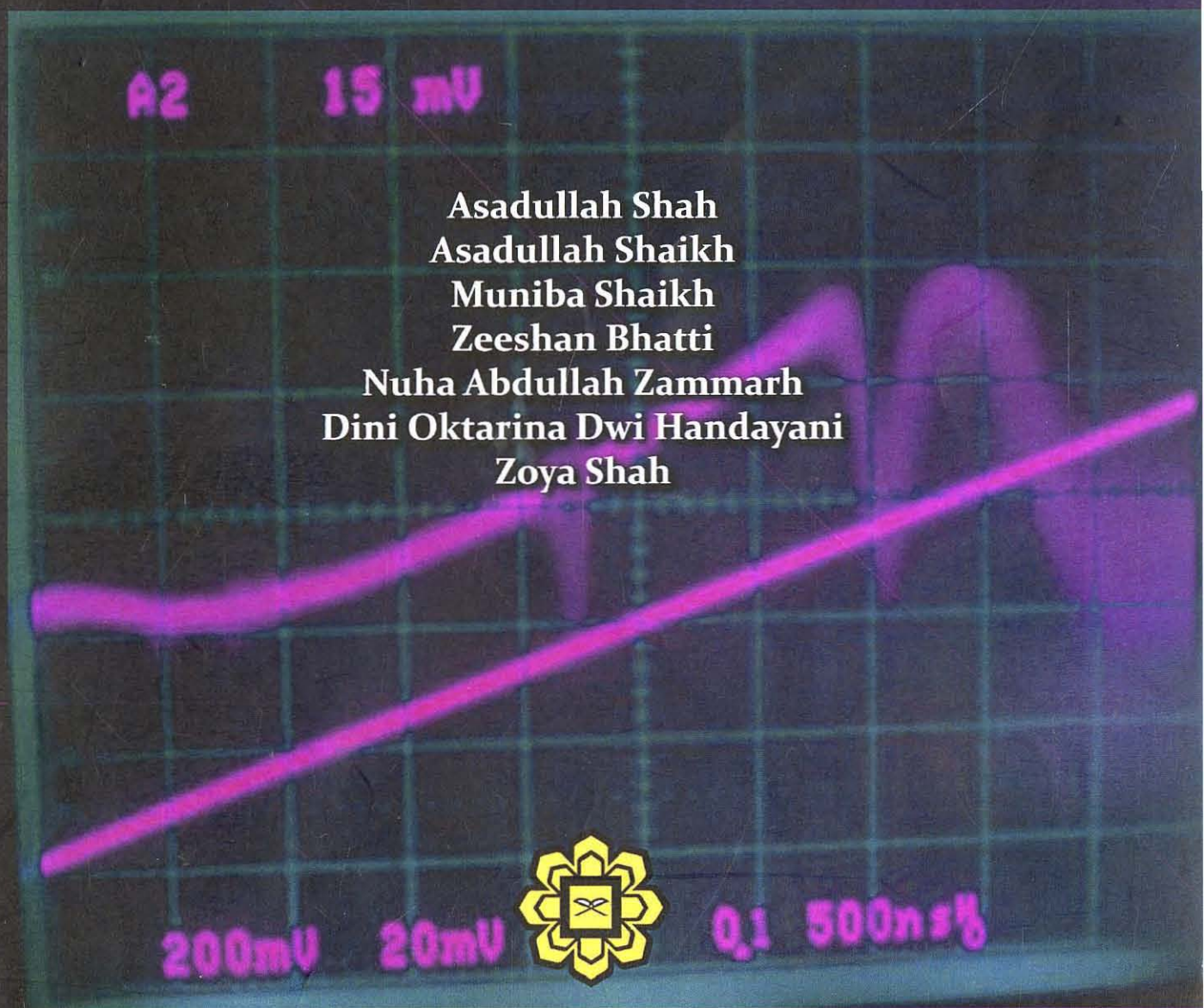

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5. Linear Predictive Coding of Speech

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5.0 Abstract

Linear Predictive Coding (LPC) is a mathematical (signal processing) technique used to remove the redundancy from speech signals. To remove the redundancy from speech signal, is done in two stages, first stage is to remove short term correlations form the signal and the second is to remove long term correlations. The short term and long term redundancies are modelled by digital filters very precisely. This chapter is dedicated for LPC of speech.

5.1 Method

Linear prediction is a well-known method of removing the redundancy in a signal. For speech, the prediction is done most conveniently in two separate prediction stages. The first prediction is based on the short-time spectral envelope of speech, well known as Shot Term Prediction (STP), and second prediction is based on periodic nature of the spectral fine structure. The short-time spectral envelope of speech is determined by the frequency response of the vocal tract and for voiced speech also by the spectrum of glottal pulse. The spectral fine structure arising from the quasi periodic nature of voiced speech is determined mainly by the pitch period. The structure for unvoiced speech is random and cannot be used for prediction.

Linear predictive coding has emerged as one of the most powerful technique for reducing the amount of information used for speech transmission and bandwidth savings of the communication link. LPC model-based coding depends heavily upon the coding of the speech source model parameters. Here the model parameters are coded and transmitted rather than the actual speech signal, unlike waveform coders such as PCM and Adaptive PCM where each individual sample is encoded separately.

In source coding of speech, the speech signal is regarded as the output from a slowly time varying parametric speech production model of vocal tract. The most widely used model of the vocal tract is the linear predictive (LP) model. In LP modeling, the vocal tract is regarded as an acoustic tube excited by a separate excitation signal. This model can thus be simplified into an excitation source and a low order filter. This filter is used to extract the short term correlations between speech samples in linear predictive coding (LPC).