

A COMPUTER-BASED ANALYSIS OF ACOUSTIC PROPERTIES OF SRI LANKAN *PIRITH* CHANTS USING VOICED TO UNVOICED RATIO AND PROBABILITY DISTRIBUTION FUNCTIONS

C Gunawardana¹ and S Gamage²

Department of Physics, University of Sri Jayewardenepura, Sri Lanka

²*shanthagamage@sci.sjp.ac.lk*

'Pirith' is a special type of chanting believed to be a protective doctrine preached by the Lord Buddha in Pali language. Generally, a voice signal consists of the fundamental frequency, F_0 and a series of harmonic frequencies called as formants, F_n . As reported by several other studies, characteristic formant frequency distributions are identified in chanting, in contrast to normal speaking. This work is dedicated to developing a phonetic picture on Pirith chants, investigating probability distribution of formants and quantifying voiced to unvoiced ratio utilizing computer-aided tools. In this study, 25 samples of each Rathana, Karaneeya Metta and Angulimala Suttas recited by male monk chanters were recorded using high precision microphone array and then it was subjected to splitting of smaller voiced segments of frame length 10 ms sampling at a rate of 44.1 kHz. In the computational speech model, a pre-emphasis filter is applied to the sampled time series of voiced segment to cancel out the effect of glottis. Then frame-by-frame

analysis was used with hamming windows and linear predictive coding (LPC) and auto correlation to extract the formant values. Voiced to unvoiced ratio is assessed using zero crossing rate and energy content of the acoustic signal. Results of the Voiced to Unvoiced ratio was over 75% of voiced frames in all types of Suttas despite number of monks involved in chanting. Having a high percentage of voiced frames, interpret strong contribution of vibrating vocal folds involved in chanting of Pirith Suttas. Further, Probability Distribution Functions (PDFs) of each Sutta is generated and compared for first five formants. Angulimala Sutta and Rathana Sutta show similar patterns in terms of PDFs while Karaneeya Metta Sutta indicates a clear discrepancy demonstrating a unique set of characteristics.

Keywords: Formant frequencies, Voiced to unvoiced ratio, Probability distribution functions