

## Recognition of Vowel Distribution for Sri Lankan Traditional Pirith Chants Using Formant Variation

M.A.C.P. Gunawardana and S.S.N. Gamage

*Department of Physics, University of Sri Jayewardenepura, Sri Lanka*

*Pirith* is believed to be a doctrine preached by Lord Buddha and regarded to obtain protection from evil, promote health and well-being. Voice source produces a harmonic series, consisting of the fundamental frequency,  $F_0$  and harmonic frequencies called as formants,  $F_n$ . Vowels can be mapped using the relationship between lip opening width to the first formant frequency,  $F_1$  and tongue constriction width to second formant frequency,  $F_2$ . This work is dedicated to developing phonetic picture on *Pirith* chants and analyze acoustic properties using computer-aided tools. As reported by several other studies, characteristic vowels and high frequency formants are identified in chanting in contrast to normal speaking. The motive of this study is to investigate vowel distribution of *Pirith* chants with the aim of special pattern recognition. Samples of *Ratana*, *Karaniya Metta* and *Angulimala Suttas* recited by male monk chanters were recorded using high precision microphone array and 15 samples of each *Sutta* were analyzed. Recorded samples were then subjected to splitting of smaller voiced segments of frame length 10 *ms* using sampling 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. Finally, PDFs of each *Sutta* is generated and compared for first five formants. *Angulimala Sutta* and *Ratana Sutta* show similar patterns in terms of PDFs but *Karaniya Metta Sutta* indicates a clear discrepancy demonstrating a unique set of characteristics. Furthermore, the vowel distribution reveals that *Angulimala Sutta* and *Karaniya Metta Sutta* contain high number of compact vowels comparing that of *Rathana Sutta*.

**Keywords:** Formant frequencies, Vowels, Probability Distribution Function (PDF)