Milind Shantilal Shah, Estimation of place of constriction during stop closures of vowel-consonant-vowel syllables, Ph.D. Thesis, Department of Electrical Engineering, Indian Institute of Technology Bombay, 2008.

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*Abstract* - Speech-training systems providing visual feedback of vocal tract shape have been found to be useful for improvement in vowel articulation by the hearing impaired. Production of vowel-stop consonant-vowel syllables involves movement of articulators from the articulatory position of the vowel towards that of the stop closure to that of the vowel. The closure segment of a stop has zero or low signal energy, and spectral information related to vocal tract filter is not available. Hence, LPC based estimation of vocal tract shape fails during stop closure. This thesis reports techniques that have been investigated for estimation of place of articulation during stop closures by performing bivariate surface modeling, based on second degree polynomial, third degree polynomial, and Delaunay triangulation, on vocal tract area values and line spectrum frequencies during transition segments preceding and following the closure and their interpolation during the closure. The technique with second degree polynomial surface modeling on vocal tract area values was found to be the most suitable, for estimating the place of maximum constriction during stop closure segments of syllables of the type /aCa/ with bilabial, alveolar, and velar stop consonants. The estimated places compared well with the actual constriction locations observed from the articulatory data in /aCa/ utterances. The technique can be used for improving effectiveness of speech-training systems for production of stop consonants by providing visual feedback of estimated place of articulation.