
**Abstract**

This paper describes a new method of deconvolving the vocal cord excitation and vocal tract system response. The technique relies on a sine-wave representation of the speech waveform and forms the basis of an analysis-synthesis method which yields synthetic speech essentially indistinguishable from the original. Unlike an earlier sinusoidal analysis-synthesis technique that used a minimum-phase system estimate, the approach in this paper generates a "mixed-phase" system estimate and thus an improved decomposition of excitation and system components. Since a mixed-phase system estimate is removed from the speech waveform, the resulting excitation residual is less dispersed than the previous sinusoidal-based excitation estimate or the more commonly used linear prediction residual. A method of time-varying linear filtering is given as an alternative to sinusoidal reconstruction, similar to conventional time-domain synthesis used in certain vocoders, but without the requirement of pitch and voicing decisions. Finally, speech modification with a mixed-phase system estimate is shown to be capable of more closely preserving waveform shape in time-scale and pitch transformations than the earlier approach.