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SOME RESULTS ON MIXED-SOURCE EXCITATIONS IN LPC SYNTHESIZERS

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In this paper, two types of mixed excitation for an LPC synthesizer, are compared. A mixed excitation is obtained by opportunely combining, the output \( u_p(t) \) of a generator of periodic impulses (the period \( p \) is equal to the pitch) with the output \( u_n(t) \) of a pseudo-random generator.

For each segment of a speech signal, indicating by \( b^2 \) the fraction of energy due to the pseudo-random excitation and by \( (1-b^2) \) the analogous fraction due to the periodic excitation, the two following questions arise:

1- How to estimate \( p \) and \( b^2 \)?

2- How to combine the two excitations, according to a parameter \( a^2-a^2(b^2) \), where \( a^2 \) is a fraction of energy analogous to \( b^2 \), but which is referred to the excitation?

As far as the first problem is concerned, a method for the estimation of \( p \) and \( b^2 \) is proposed. This method makes use of the following function, called "function of similarity":

\[
S(t) = \frac{\sum_{k=1}^{K} s(k) \cdot s(k+1)}{\sqrt{\sum_{k=1}^{K} s^2(k)} \cdot \sqrt{\sum_{k=1}^{K} s^2(k+1)}}
\]

This method is then compared, with a second method, which makes use, for the estimation of \( b^2 \), of the a priori probabilities of voiced or unvoiced sources, which are computed by means of a bayesian procedure.

With reference to the second problem, and indicating by \( h_B(t;f) \) and \( h_A(t;f) \) the impulse responses of a low-pass filter and a high-pass filter respectively, with a cut-off frequency \( f \), two alternatives are compared. In the first case, the mixed-source excitation is the simple linear combination:

\[
u(t) = \sqrt{2}[(1-a^2)u_p(t) \cdot h_B(t,f)+a^2u_n(t) \cdot h_A(t,f)]
\]

\( f = 2000 \) Hz

In the second case, the combination is obtained by adding the output of the voiced and unvoiced sources, opportunely filtered by means of the preceding filters, with a cut-off frequency \( f_T = a^2f_N \) (\( f_N \) is the Nyquist frequency). One can then write:

\[
u(t) = u_p(t) \cdot h_B(t;f_T)+u_n(t) \cdot h_A(t;f_T)
\]

\( f_T = a^2f_N \)