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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 a 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 refered to the excitation ?

As for 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" :

$$S(i)=\frac{\sum_{k=1}^{i} s(k).s(k+i)}{\sqrt{\sum_{k=1}^{i} s^2(k)}\ \sqrt{\sum_{k=1}^{i} s^2(k+i)}}$$

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 :

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

$$f=2000\ Hz$$

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:

$$u(t)=u_p*h_B(t;f_T)+u_n(t)*h_A(t;f_T)$$

$$f_T=a^2f_N$$