INTRODUCTION

In this chapter, we propose a modification of the classical CELP (Code Excited Linear Predictive) algorithm in order to reduce its computational complexity and required memory size, while preserving the quality of the reconstructed speech.

Rather than performing the individual weighting of each candidate sequence, we suggest a global implementation of the vocal tract weighting function at the code-book level, thanks to the use of an adaptive code-book. As a result, the analysis-by-synthesis procedure does not require the processing of all the candidate sequences through the synthesis and weighting filters, and therefore the complexity requirement of the algorithm is much reduced.

The chapter is organized as follows. In the first section, we briefly remind the classical CELP algorithm, as well as the main directions of the re-
search works which have been largely developed in the past years to overcome the CELP native complexity, and we introduce our own approach to this problem. In the second section, we describe the basic technique which can be used to implement the weighting at the code-book level. We also give an alternate approach to this implementation, and we report the results of the application of this technique to two architectures: the CELP and the SELP (Stochastically Excited Linear Predictive coder). In the last section, we describe an implementation of a 7.2 kbps adaptive code-book CELP (ACELP) on a fixed point DSP, which requires a processing capability of 7 MIPS. The speech quality is reported from formal quality tests which show that the 7.2 kbps ACELP algorithm presents the same level of quality as the GSM algorithm which operates at 13 kbps with a processing requirement of 4 MIPS.

CELP DEVELOPMENTS

Originally proposed by B.S. Atal and M.R. Schroeder [1,2], the Code Excited Linear Prediction (CELP) algorithm is a method using vector quantization for high quality speech coding at low bit rates.

Fig.1. Basic CELP (Atal and Schroeder, 1984)