Designs of Variable Fractional Delay Digital Filter and Fractional Order Differintegrator

Cheng-Han Chan


Abstract

For the past decade, the design of variable digital filters became one of the most important branches in digital signal processing because of the self-adjustable ability of a variable digital filter online. The variable digital filters are generally classified into two categories. One is the filters with adjustable magnitude response such as the filters with variable cut-off frequencies and the variable fractional-order differentiators/integrators. The other is the filters with variable fractional-delay response. In this dissertation, the weighted least-squares method will be proposed to design variable digital filters. Generally, a general weighted least-squares method can be applied directly to find the optimal solution when the objective error can be formulated in a linear function. On the contrary, when the problem concerns a nonlinear optimization, an iterative quadratic method is applied. Furthermore, if it is desirable to minimize a specified maximum error, the technique of iterative weighted least-squares method will be used which constitutes the inner loop of the overall procedures while the iterative method stated above makes up the outer loop. In this dissertation, the stated method will be applied to the following topics: Minimax design of variable fractional-delay FIR digital filters by iterative weighted least-squares approach (Chapter 2). A new criterion for the design of variable fractional-delay FIR digital filters (Chapter 3). A new structure for the design of variable fractional-delay FIR digital filters (Chapter 4). Minimax phase error design of allpass variable fractional-delay digital filters by iterative weighted least-squares method (Chapter 5). A new method for least-squares and minimax group-delay error design of allpass variable fractional-delay digital filters (Chapter 6). A new method for the design of variable fractional-delay IIR digital filters (Chapter 7). An iterative method for the design of variable fractional-order FIR differintegrators (Chapter 8). A new structure for the design of wideband variable fractional-order FIR differentiators (Chapter 9). Iterative design of variable fractional-order IIR differintegrators (Chapter 10).

References


Description of document (in Chinese)
詹政翰,可調分數延遲數位濾波器及分數階微積分器之設計, 博士論文,國立高雄第一科技大學, 電腦與通訊工程所, 2010.