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Recursive Doubly Complementary Filter Design Using Particle Swarm Optimization

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Abstract : This paper deals with the optimal design of recursive doubly complementary (DC) digital filter design using a metaheuristic based optimization technique. Based on the theory of DC digital filters using two recursive digital all-pass filters (DAFs), the design problem is appropriately formulated to result in an objective function which is a weighted sum of the phase response errors of the designed DAFs. To deal with the stability of the recursive DC filters during the design process, we can either impose some necessary constraints on the phases of the recursive DAFs. Through a frequency sampling and a weighted least squares approach, the optimization problem of the objective function can be solved by utilizing a population based stochastic optimization approach. The resulting DC digital filters can possess satisfactory frequency response. Simulation results are presented for illustration and comparison.

Keywords : doubly complementary, digital all-pass filter, weighted least squares algorithm, particle swarm optimization
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