Abstract

This paper aims to establish a solution methodology for the optimal design of digital infinite impulse response (IIR) filters by integrating the features of cat swarm optimization (CSO) and differential evolution algorithm (DE). DE is a population based stochastic optimization technique which optimizes real valued functions. It requires negligible control parameter tuning but sometimes causes instability problem. CSO is a heuristic optimization algorithm based on the observations and imitation of the natural behavior of cats. CSO algorithm possesses local as well as global search capabilities. Although, CSO possesses better capability to search optimal point but it requires a higher computation time because the local and global searches are carried out independently in each iteration. A hybrid algorithm is proposed using the CSO algorithm and the DE optimization algorithm for the robust and stable design of digital IIR filter. To start with a better solution set, opposition based learning strategy is incorporated. The proposed method explores and exploits the search space locally as well as globally. The design criterion undertakes the minimization of magnitude approximation error and ripple magnitudes of both pass-band and stop-band satisfying the stability requirements. The developed hybrid algorithm is effectively applied for designing the digital low-pass, high-pass, band-pass and band-stop filters. The computational results demonstrate that the proposed algorithm is capable of creating designs that are competitive with reference to other design
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processes and can efficiently be applied for higher order filter design.

References

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Index Terms

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Digital IIR filters  cat swarm optimization  differential evolution  multiparameter optimization  opposition based learning.