Improved particle swarm optimization (PSO) for performance optimization of electronic filter circuit designs

Abstract

This article discusses and analyzes particle swarm optimization (PSO) approach in the design and performance optimization of a 4th-order Sallen Key high pass filter. Three types of particle swarm features are studied: basic PSO, PSO with regrouped particles (PSO-RP) and PSO with diversity embedded regrouped particles (PSO-DRP). PSO-RP and PSO-DRP are proposed to solve the stagnation problem of basic PSO. Based on the developed PSO approaches, LTspice is employed as the circuit simulator for the performance investigation of the designed filter. In this paper, 12 design parameters of the Sallen Key high pass filter are optimized to satisfy the required constraints and specifications on gain, cut-off frequency, and pass band ripples. Overall results show that PSO with diversity embedded regrouped particles improve the conventional search of basic PSO and has managed to achieve the design objectives.