PAPER NUMBER 5

TITLE: Design of a Low-pass Filter from Fractional Chebyshev Polynomials

ABSTRACT:

This paper introduces a novel magnitude approximation for the fractional-order Chebyshev low-pass filter. The proposed magnitude response is constructed from the fractional Chebyshev polynomials originating from the series solution of fractional-order Chebyshev differential equation. The transfer function of the fractional-order Sallen-Key biquad is used as a prototype for the approximation. To identify the coefficients of the Sallen-Key topology, the flower pollination algorithm (FPA) is used to minimize an objective function representing the sum of relative magnitude error. The optimization problem is executed in MATLAB, and stable solutions are chosen for the implementation. Two different cases are investigated corresponding to filter orders 1.8 and 2.7. LT-Spice is used for circuit simulations, and the Valsa approach is used for fractional-order capacitor approximation. The original magnitude response is compared with the optimized one and the circuit simulation results, and this comparison shows a magnitude error less than 2%.

CONTRIBUTION OF THE APPLICANT:

- Literature review.
- Ideas involved.
- The mathematical model and its solution.
- Analysis of the results.
- Writing up the manuscript.

CONTRIBUTION PERCENTAGE AND SIGNATURES OF COAUTHORS:

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