

## **PAPER # 4**

- **TITLE:**

### **Fractional order Chebyshev-like low-pass filters based on integer order poles.**

- **YEAR OF PUBLICATION:** August 2019

- **JOURNAL:** Microelectronics

- **ABSTRACT:**

Chebyshev filter is one of the most commonly used prototype filters that approximate the ideal magnitude response. In this paper, a simple and fast approach to create fractional order Chebyshev-like filter using its integer order poles is discussed. The transfer functions for the fractional filters are developed using the integer order poles from the traditional filter, .

This approach makes this work the first to generate fractional order transfer functions knowing their poles by constructing the denominator of the transfer function.

The magnitude, phase, and step responses are simulated for different fractional orders showing their Chebyshev-like characteristics. Circuit simulations using Advanced Design Systems of active and passive realizations of the proposed filters are also included and compared with MATLAB numerical simulations proving the reliability of the design procedure.

As a conclusion, Increasing the order of Integer order Chebyshev filter will improve the frequency domain requirements but will have worse time domain

response but using fractional order Chebyshev filter will improve the frequency domain requirements without nearly affecting time domain response. i.e., using Chebyshev filter with order 3.3 will be better than with order 4, as fractional calculus gives more accurate models with fewer number of parameters