PAPER # 7

- **TITLE:**

Hermite Polynomials in The Fractional Order Domain Suitable for Special Filters Design.

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- **ABSTRACT:**

Extending the first and second order filters to the fractional-order domain provides extra degree of freedom and properties that were not attainable in the integer order case.

In this paper, the fractional order of the well-known Hermite differential equation is proposed based on Caputo fractional operator, the proposed equation is solved by using fractional Taylor power series method.

Two linearly independent solutions are introduced, these two solutions are converged for all values of x, and the relation between the convergence rate and the fractional order operator are studied.

The Hermite Polynomial solution and its region of convergence are deduced from the two independent solutions, and the condition of having finite number of terms in the Hermite polynomial solution is studied also.

In the traditional case, the polynomial solution of the Hermite differential equation was scaled to have the coefficient of xn equal to 2n, and the resulting polynomial are known as Hermite Polynomial, in this paper; scaling procedure is introduced to ensure bounded behavior of the fractional polynomial for a finite interval.

This procedure based on finding the critical point, and then scale the polynomial by the maximum, finally; multiplied it by the sign of the largest power.

Finally, proposed magnitude response for Fractional order Hermite filter is presented.