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Differential equations from Fibonacci-Sigmoid polynomials with hybrid coefficients

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Abstract. This paper investigates a novel class of differential equations whose solutions are governed by Fibonacci-sigmoid polynomials. These polynomials combine the growth behavior of sigmoid functions with the recursive structure of Fibonacci numbers. The differential equations are constructed with coefficients derived from Fibonacci-based extensions of Euler and Bernoulli numbers, introducing unique nonlinear dynamics. Analytical techniques and symbolic computations are employed to explore the behavior and stability of these equations. This fusion of discrete and continuous structures contributes to new insights in the study of special functions and nonlinear systems.

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