Extended discrete transformation method for nonlinear systems of ordinary and fractional differential equations

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We present an extension of the discrete transformation method for numerical solution of nonlinear oscillatory, possibly chaotic systems, of both ordinary and fractional differential equations. The method is applied at each integrating timestep by constructing a local solution in a form of a truncated series, which are power series in the case of ordinary differential equations, and fractional series in the case of fractional differential equations. To illustrate the numerical approach, we analyze several examples of chaotic oscillatory systems of differential equations of both ordinary and fractional type, and provide a detailed bifurcation analysis of the solutions depending on the system parameters. We also make a comparative analysis of the proposed method with some standard methods for numerical solution of differential equations.

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