



On the Positivity and Stability Analysis of Conformable Fractional COVID-19 Models

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Abstract: In this paper, we present a novel nonlinear fractional conformable SEIR compartmental model with a vaccination compartment. This SEIHRDV model is one of the next generation models that better explores nonlinear disease behaviour. The main aim of this study is to test when such a model is locally asymptotically stable, respectively, globally asymptotically stable around its equilibrium points: the disease-free state X_0 and the endemic state X_1 . To achieve this, we introduce the Sumudu transform as an innovative integral approach to solve the differential equations, compute the basic reproduction number R_0 , and construct a Lyapunov function to rigorously establish the stability conditions. Numerical solutions are then obtained using the Rang-Kutta 4th order method, and graphical simulations are performed in MATLAB (version 2023a) to further validate the theoretical findings and illustrate the applicability and the accuracy of the proposed approaches.

Keywords: *nonlinear model; conformable derivative; positivity analysis; local and global stability; Sumudu transform; COVID-19 models.*

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