

A FRACTIONAL ORDER MODEL FOR DYNAMICS OF DENGUE TRANSMISSION

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Abstract. This paper presents a compartmental fractional order dengue transmission model with nonlinear incidence function in the sense of Caputo fractional operator. The fractional order is raised to power of some sensitive parameters to enhance flexibility of the proposed model and reflect most on infection dynamics. A qualitative analysis of the model has been done, including mathematical proofs of existence and boundedness of non-negative solutions of the fractional order system, finding threshold parameter and establishing local and global stability. The sensitivity analysis has also been performed to observe the influence of some key parameters. Finally, rigorous numerical simulations have been carried out to illustrate the characteristics of solution curves and impact of fractional order on dynamics..

Keywords. Dengue model, Fractional order system, Sensitivity, Simulation, Steady state.

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1 Introduction

Currently more than one third of total population in the world is susceptible from infectious vector-borne diseases (VBD) like dengue, which is caused by any of the four serotypes- DEN I, DEN II, DEN III and DEN IV and transmitted mostly by *Aedes aegypti* female mosquitoes [1]. Infection of dengue with one serotype provides homotypic immunity for lifetime but an individual can be infected by other three [2]. As per recent report from World Health Organization (WHO), an unexpected rise of dengue cases of historic high 6.5 million is recorded in 2023 with 7300 deaths [3]. It was expected that infectious diseases will eliminate by the mid of 20th century [4] but it is always challenging mainly in developing countries due to numerous factors like limitation of resources and vaccinations, non-standard living etc.