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Analysis of Dengue Disease Transmission Model with General Incidence Functions

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Abstract: In this work, we propose a non-linear system of differential equations that models the dynamics of transmission of dengue fever. Then, we perform a stability analysis of this model. In particular, we prove that when the threshold of the model called the basic reproduction ratio is less than unity, the disease-free equilibrium is globally asymptotically stable. Furthermore, when this value is greater than unity, under suitable conditions, the endemic equilibrium is globally asymptotically stable. Some numerical simulations are provided to illustrate the obtained theoretical results. We also propose a global sensitivity analysis of the basic reproduction ratio.

Keywords: *dengue; general incidence function; mathematical analysis; basic reproduction number; Lyapunov function; stability analysis; sensitivity.*

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1 Introduction

Mathematical modelling and numerical simulation are important decision tools that can be used to study and control human and animal diseases [1, 2]. However, to tackle real situations, the resulting models need to be adapted to each specific disease and its biological characteristics [3].

From a general point of view, mathematical models are used to predict the behaviour of a disease in a particular population [4, 5]. In particular, they help to determine if the disease under consideration will be endemic (i.e., it remains active in the population)

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