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Covid 19 Mathematical model and applications - The case of China

OPhir Nave [1,*]

[1] Jerusalem College of Technology
* Correspondence: naveof@gmail.com

Abstract: In general, a mathematical model that contains many linear/nonlinear differential equations, describing a phenomenon, does not have an explicit hierarchy of system variables. That is, the identification of the fast variables and the slow variables of the system is not explicitly clear. The decomposition of a system into fast and slow subsystems is usually based on intuitive ideas and knowledge of the mathematical model being investigated. In this study, we apply the singular perturbed vector field (SPVF) method to the COVID-19 mathematical model to expose the hierarchy of the model. This decomposition enables us to rewrite the model in new coordinates in the form of fast and slow subsystems and, hence, to investigate only the fast subsystem with different asymptotic methods. In addition, this decomposition enables us to investigate the stability analysis of the model, which is important in the case of COVID-19. We found the stable equilibrium points of the mathematical model and compared the results of the model with those reported by the Chinese authorities and found a fit of approximately 96%.

Keywords: Mathematical Modeling; COVID-19; Coronavirus; Stability Analysis; Singular Perturbed System

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