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Study on population dynamics using delay differential equation

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The study of population dynamics is important to biologists, epidemiologists, ecologists, microbiologists, and bio analysts. The mathematical modelling approach is the most powerful and reliable technique to govern the dynamics of the population in real-world applications. Describing the dynamics of a population through mathematical models is very useful in order to observe the trend and predict the behaviour of the population for future requirements. In the literature, there exist differential models for describing the growth rates of populations over time. This study will aim to explore some different models of population dynamics, including a basic exponential growth model and a logistic growth model. In the great interest of proposing an efficient model for population dynamics, this paper will introduce the idea of the delay differential equation in population modelling as it is an important aspect in real world application. Delay differential equations exhibit much more complicated dynamics than ordinary differential equations since a time delay could cause a stable equilibrium to become unstable and cause the population to fluctuate in the ecosystem. In this paper, we are going to review the existing models and introduce the time delay differential model for human population dynamics. As an application, the available actual population growth of Sri Lanka from 1980 to 2020 is used to estimate the parameters of exponential, logistic and time delay differential models. The obtained result illustrates the significance of the approaches for describing population dynamics.

Keywords: Population dynamics, Differential models, Delay differential equations.