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Analyzing unemployment dynamics in the context of the COVID-19 pandemic: A mathematical modeling approach

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The proposed model establishes a mathematical system utilizing nonlinear ordinary differential equations to examine the effects of COVID-19 on the unemployed population. The system employs a four-dimensional model by considering four key variables to understand the attributes of the pandemic on the job market. The robustness of the model is ensured by proving its positivity and boundedness, which guarantees that the system remains realistic under various conditions. The paper addresses the local stability of the system using the Routh–Hurwitz criteria. Global stability of the system is explored using Lyapunov function of dynamical systems ensuring that the system behaves in a stable manner over time. The practical relevance of the model is adorned using optimal control theory which is applied through the use of three control functions. The controls are intended in a way, aiming to diminish the negative impacts of pandemic on unemployment and seeking better career opportunities in the future. The obtained results are well accompanied using numerical simulation which confirms the model is significant in enhancing the improved career opportunities during the arduous times which makes it a valuable tool for researchers.

Keywords: Unemployment; Routh–Hurwitz criteria; control theory, Lyapunov function; stability analysis; numerical simulation.

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1. Introduction

Unemployment is a situation in which people seek a job but cannot find one. This issue is a personal problem for affected individuals and becomes a major concern in

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