

ANALYZING SMOKING BEHAVIOR WITH GEGENBAUER POLYNOMIAL APPROXIMATION

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ABSTRACT

This study aims to forecast the smoking behaviors of individuals classified into five distinct groups: potential smokers or non-smokers, light smokers, heavy smokers, and those who have either temporarily or permanently quit smoking. The interactions among these groups are represented by a system of five ordinary differential equations, each corresponding to one subgroup. To solve this system, the Gegenbauer polynomial expansion is employed, enabling accurate approximation of the system's behavior over the wide interval [0, 100]. This approach facilitates a comprehensive analysis of the long-term dynamics under four different sets of initial conditions. Since the system does not admit an analytical solution, the numerical results obtained from the Gegenbauer method are validated by comparison with both the classical fourth-order Runge-Kutta method and Mathematica's built-in differential equation solver. The simulation results illustrate the evolution and interaction of the various smoker groups over time.

Keywords Gegenbauer polynomials · Smoking model · Disease modeling

References

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