A Simple SEIR Epidemic Dynamics Model for the Spread of Simple SEIR Epidemic Dynamics Model for the Spread of Traffic in Urban Networks

Md. Riad Hossen
Department of Mathematics, Bangladesh University of Engineering and Technology (BUET), Dhaka 1000, Bangladesh

Hami Jafar Koushik
Department of Mathematics, Bangladesh University of Engineering and Technology (BUET), Dhaka 1000, Bangladesh

Mohammed Forhad Uddin*
Department of Mathematics, Bangladesh University of Engineering and Technology (BUET), Dhaka 1000, Bangladesh

Abstract:

This study presents a novel approach to modeling the spread of congestion in urban networks by adapting the classical SEIR (Susceptible-Exposed-Infected-Recovered) epidemic dynamics framework. Drawing analogies between the spread of diseases and the propagation of traffic jams, the study aims to capture the nonlinear dynamics of traffic congestion and provide insights into traffic management strategies.

The model incorporates a simple contagion process that simulates the transmission of traffic congestion across intersections and road segments. Key factors such as vehicle density, road network topology, and traffic flow disruptions are included. By adapting the SEIR model, susceptible vehicles become exposed to traffic jams and eventually infected. Additionally, the model integrates traffic-driven SIR epidemic spreading to explore the mutual influence between traffic jams and epidemic outbreaks in urban environments.

Numerical simulations demonstrate the effectiveness of the proposed model in predicting traffic congestion patterns. The results provide valuable insights into the propagation of traffic jams and highlight potential strategies for mitigating urban traffic congestion.

The findings suggest that epidemic-inspired models can serve as powerful tools for traffic management in complex urban systems. This approach bridges the gap between traffic

engineering and epidemiological modeling, offering new perspectives for managing congestion and enhancing urban mobility.

Keywords:

Traffic Congestion; Urban Network; SIR Model; Sensitivity Anaslysis.