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Liang'an Huo, Chenyang Ma

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ACCEPTED MANUSCRIPT

# The interaction evolution model of mass incidents with delay in a social network

Liang'an Huo *, Chenyang Ma
Business School, University of Shanghai for Science and Technology, Shanghai 200093, China

*Abstract:* Recent years have witnessed rapid development of information technology. Today, modern media is widely used for the purpose of spreading information rapidly and widely. In particular, through micro-blog promotions, individuals tend to express their viewpoints and spread information on the internet, which could easily lead to public opinions. Moreover, government authorities also disseminate official information to guide public opinion and eliminate any incorrect conjecture. In this paper, a dynamical model with two delays is investigated to exhibit the interaction evolution between the public and official opinion fields in network mass incidents. Based on the theory of differential equations, the interaction mechanism between two public opinion fields in a micro-blog environment is analyzed. Two delays are proposed in the model to depict the response delays of public and official opinion fields. Some stable conditions are obtained, which shows that Hopf bifurcation can occur as delays cross critical values. Further, some numerical simulations are carried out to verify theoretical results. Our model indicates that there exists a golden time for government intervention, which should be emphasized given the impact of modern media and inaccurate rumors. If the government releases official information during the golden time, mass incidents on the internet can be controlled effectively.

*Keywords*: Public opinion fields; network of mass incident; interaction evolution model; Hopf bifurcation

## 1.Introduction

Rumors, which are a typical social phenomenon, have always been a concerning public issue, especially in times of emergencies. The impact and consequences of rumors should not be underestimated. Further, owing to the emergence and rapid development of widely popular social networking platforms, rumors tend to spread faster, and forms of rumors have become more diversified. Moreover, rumors also influence the decisions of official authorities and the spread of official information. When official media does not issue a statement or when they seldom release information, various rumors that distort the truth tend to spread quickly [1, 2]. Therefore, it is pertinent that governments use official media to disclose accurate information about a situation or an event in a timely manner, and to avoid any form of public suspicion [3]. The spread of rumors can result in the occurrence of undesirable outcomes, particularly when emergencies occur, in such cases, official authorities must release relevant information in a timely manner to avoid the spread of rumors.

Given the undesirable outcomes of the spread of rumors, rumor spreading has been extensively studied by many scholars. Along these lines, the DK model proposed by Daley and Kendall in 1965 [4] and the MT model proposed by Maki and Thompson in 1973 [5] are the early classical rumor models. Zanette applied the complex network theory to study the rumor spreading and established a rumor model

*Corresponding author：huohuolin@yeah.net

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