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Bifurcation analysis of traffic flow through an improved car-following model considering the time-delayed velocity difference

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### Highlights

- 1) A new car-following model with consideration of time-delayed velocity difference (TDVD) is proposed to investigate the influence of time-delayed velocity on traffic flow via bifurcation analysis. The stability condition is obtained by linear analysis.
- 2) We conduct the Hopf bifurcation analysis for TDVD model via theoretical analysis and numerical computation. The results show that there exist Hopf bifurcation critical points and the position of the critical points is found to be located on the boundary of the instability region. This indicates the Hopf bifurcation causes the loss of stability in TDVD model to generate traffic jams.
- 3) Finally, the influence of the delay time and sensitivity of velocity difference on the Hopf bifurcation is discussed, respectively.

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