Investigating Car Following Model

Kaeshav Danesh and Kevin Phan

April 8, 2022

Abstract

Traffic flow dynamics is generally split into either macroscopic models or microscopic models. For this paper, we will focus on car following models which is a type of microscopic model. We first introduce the assumptions and the mathematical description car following model and the numerical scheme used to compute them. Then, we give the full velocity difference model. Finally, we examine different scenarios such as car crashes, phantom traffic, traffic light, and lane changes and analyze the behavior of cars.

Contents

1 Introduction

Some questions to answer:

- Why are traffic models important?
- At what scale does our model operate at?
- What assumptions are we making?

2 General Model

2.1 Mathematical Formulation

We follow the mathematical formulation of car following model in [TK13].

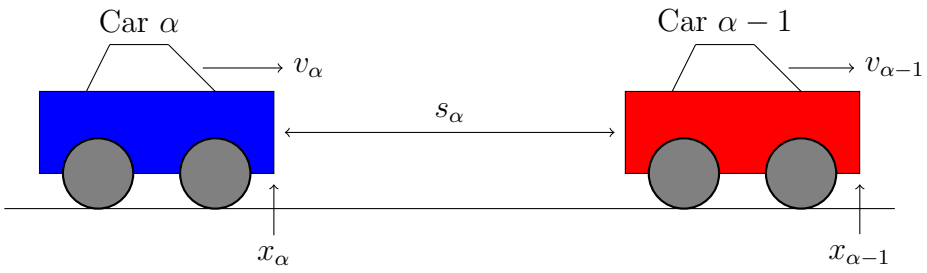

Figure 1: Defining index, position, velocity, and gap of a car.

2.2 Numerical Scheme

[Ste11]

3 Car Following Model

3.1 Full Velocity Difference Model

4 Examining Different Scenarios

4.1 Car Crash

4.2 Phantom Traffic

4.3 Traffic Light

4.4 Lane Changes

5 Conclusion

6 Further Remarks

List of Symbols and Constants

x	position [see ch. 2.1].
v	velocity
a	acceleration
t	time
F	force
s	gap
v_0	desired speed (typically 33 m/s) [see ch. 3.1]
τ	adaptation time (typically 0.65 s)
γ	speed difference sensitivity

References

[Ste11] David E. Stewart. *Dynamics with Inequalities*. SIAM, 2011. ISBN: 978-1-611970-70-8.

[TK13] Martin Treiber and Arne Kesting. *Traffic Flow Dynamics: Data, Models and Simulation*. Berlin Heidelberg: Springer, 2013. ISBN: 978-3-642-32459-8.