A Five Phase Interpretation of a Continuum Traffic Flow Model

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Traffic models are fundamental to our ability to deal with traffic congestion in the modern world. Locating traffic congestion points are beneficial as the Government can find solutions to divert the traffic away from those points in advance. The basis of all traffic models is the Three Phase Traffic theory which is comprised of free flow, synchronized flow, and wide moving jam. One significant flaw of the Three Phase Traffic Theory is that there are actually more than three phases in traffic flow which reduces the accuracy of traffic congestion points in application. In my research, I have modified the three phase theory by deriving a set of equations which work with five explicitly defined and distinct phases. I used McCormack's Scheme along with Lax-Friedrich's method and Runge Kutta time stepping to convert partial differential equations to a form of difference equations. These methods are necessary to simplify the computations and accommodate for the form of initial conditions used in these equations. The five phase theory I developed, predicts congestion intervals if the traffic flow satisfies the Aw Rascle and Zhang PDEs, coupled with specific initial conditions. Along with real time data which must be added as a further set of equations, the entire system of equations should be able to reasonably predict points where traffic lights or other alternatives could be added. The significance of this research is to give an example of a more complicated congestion system that can occur in practice; by a subtle choice of initial conditions, it was seen that when such conditions occur at the outset, congestion can occur at various points in time. The work shows examples of cases where congestion will originate.

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