Project Report

Polytech Nice

Simple Road Traffic Modeling

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1 Presentation of the Subject

1.1 Useful Definition

Ordinary Differential Equation (ODE):

An ODE is a mathematical equation that relates a function to its derivatives with respect to one or more independent variables. ODEs are commonly represented given a function F of x, y, and derivatives of y. Then, an equation of the form

$$F\left(x, y, y', \ldots, y^{(n-1)}\right) = y^{(n)}$$

Figure 1: **Road traffic :** In this picture, you can see an example of a road traffic phenomenon that we could study

1.1.1 Simple Road Traffic Modeling

What is Road Traffic Modeling The Road Traffic modeling is the study of how vehicles behave on road networks, aiming to simulate and analyze various aspects of traffic flow, congestion, and driver behavior. This field involves creating mathematical and computer models to understand and predict traffic patterns, particularly in scenarios such as congestion, erratic driving, and other relevant factors affecting road transportation. Road traffic modeling plays a crucial role in urban planning, traffic management, and the development of intelligent transportation systems (you could see an exemple on the 1).

1.1.2 Using GitHub for Project Management

2 The equation for SMRT

2.1 Differential Ordinary Equation

In this part, the idea is to resolve two types of systems of Ordinary Differential Equations (ODEs) that allow us to simulate traffic flow. To achieve this, we will use the Euler Explicit method to numerically solve the solutions. The Euler Explicit method is given by the folowing eqution :

- EDO to solve: $\boxed{y'(t) = f\big(t, y(t)\big)}$.
- First step of the resolution: $\boxed{y_0 = y(t_0)}$.
- Recursive process to find the n-th solution of the EDO: $\boxed{y_{n+1} = y_n + hf(t_n, y_n)}$

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