
EFFECTS OF AUTONOMOUS VEHICLES ON PARTICULATE MATTER

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ABSTRACT

A significant source of air pollution is the emissions due to vehicular traffic. The latter is affected by features of vehicles and driving habits which can exacerbate emissions. On the other side, air pollutants have impact on human health and life quality in general. A strong correlation was found between the presence of particulate matter and indicators such as health and school performance. This work aims to analyze the potential positive effect of autonomy on the reduction of pollutants. The approach is based on comparing particulate matter emissions linked to different traffic conditions, which in turn are regulated via the insertion of a small number of autonomous vehicles in bulk traffic. Traffic data are gathered from an experiment exhibiting the appearance of stop-and-go waves for a fleet of twenty vehicles traveling on a ring road, and the subsequent wave dampening via longitudinal controls implemented on a single autonomous vehicle. It is shown how the wave dampening causes a significant reduction on particulate matter emission. Then, using the principal chemical reactions in atmosphere, a system of differential equations for the concentrations of the principal pollutants at street level is defined and numerically solved. This in turn provides estimates on the presence of various air pollutants due to traffic emissions and their reduction thanks to the traffic smoothing via autonomous vehicles.

Keywords road traffic · emissions · particulate matter · differential equations

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