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Modeling and control of mixed-autonomy traffic: Toward benefit for all road users from vehicle automation

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***Abstract*— This tutorial talk is motivated by the possibility of a small number of automated vehicles (AVs) that may soon be present on our roadways, and the impacts they will have on traffic flow. This automation may take the form of fully autonomous vehicles without human intervention (SAE Level 5) or, as is already the case in many modern vehicles, may take the form of driver assist features such as adaptive cruise control (ACC) or other SAE Level 1 and 2 features. Regardless of the extent of automation, the introduction of such vehicles has the potential to substantially alter emergent properties of the flow while also providing new opportunities for control of the traffic flow. However, AVs and automation features may initially be quite costly and restricted only to a small number of road users, thus restricting the benefit to only those who can afford AVs. Instead, growing research has suggested that AVs can be used to improve traffic flow conditions for all road users, even those who do not use AV technology [1].**

In this talk, I review recent work that suggests how AVs in the traffic flow may alter traffic dynamics [2]–[4]. Next, I will review a few traffic flow control techniques (e.g., ramp metering [5]), and discuss how they can be modified to be socially equitable in a mixed-autonomy setting [6], while still relying on legacy infrastructure. This tutorial reviews how vehicle automation may impact traffic dynamics, and highlights recent work on how to close the loop with new traffic controllers that leverage these flow dynamics and equitably reduce travel time for all road users.

References

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