

Safe Motion Control of Autonomous Vehicle Ski-Stunt Maneuvers

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I. ABSTRACT

A ski-stunt maneuver is a type of aggressive vehicle motions in which a four-wheel vehicle runs on two wheels on one side, and the other two wheels are lifted in the air. It is a challenging task even for skilled car drivers to perform a ski-stunt maneuver. We present the safety-guaranteed motion control of autonomous ski-stunt maneuvers. Inspired by bicycle dynamics, a vehicle dynamic model is first built for ski-stunt motion. To prevent possible rollovers, a control barrier function is used in a model predictive control formulation to plan a safe motion trajectory. A motion controller is then designed to follow the safe trajectory with guaranteed balance. Ski-stunt maneuver initiation and switching strategies are also analyzed and designed. Extensive experiments are conducted using a scaled truck platform to demonstrate the control design. The experimental results confirm that the vehicle can successfully initiate the ski-stunt maneuver to safely navigate among obstacles and narrow passes and then switch to normal driving.

A. Paper Info

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