# Mixed-Integer Model-Predictive Control for Automotives

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**Abstract:** Mixed–integer optimal control problems (MIOCPs) in ordinary differential equations (ODEs) have gained increasing interest over the last years. This is probably due to the fact that the underlying processes have a high potential for optimization.

Nonlinear model-predictive control (NMPC) has emerged as the method of choice for closed-loop optimal control of nonlinear dynamic processes. Here, a sequence of optimization problems based on a first order model of the process is solved in real-time. This allows to react to disturbances, keep the process operation within prescribed constraints, and maintain optimal performance.

In this contribution we present techniques and algorithms for efficient model-predictive control of nonlinear processes with continuous and integral controls. The latter are treated by reformulations using convexification techniques.

Our computations make use of a direct method in which infinite–dimensional control functions are discretized by basis functions and corresponding finite–dimensional parameters that enter into the optimization problem. We present adaptions to the case of problems with many control functions, such as those obtained from the convexifying reformulation.

Finally, we discuss typical mixed-integer NMPC examples and scenarios from automotive control and present computational results.

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