The application of model predictive control to path following by cars
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This is a relatively new approach to optimal path following control based on previous work, which has been based in Linear Quadratic Regulator theory. Some background material can be found in the thesis of Guilhem Leblon (M Sc September 2004). Also, the topic is well supported by a growing number of textbooks, for example "Predictive Control with Constraints" by J. M. Macieowski, Prentice Hall, 2002.

The task is to set up a non-linear (virtual) car with a view of the (realistic) road ahead of it and to use model predictive control techniques to work out the steering control sequence which will make the car optimally follow the road. The car/driver system then makes a step in discrete time along the path, using the first stage of the optimal control and re-evaluates the ideal control from the updated viewpoint. To avoid very long computations, it is of interest to use the "old" solution as a basis for finding the new one quickly. The first point of interest is to compare MPC solutions with existing LQR solutions, to understand better how the force saturation features of the nonlinear car affect the optimal control strategy. With the computational procedure working, it becomes possible to mimic the steering control of a racing driver and to solve minimum-time optimisation problems in an efficient manner.