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Title: Some new developments in model predictive control

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ABSTRACT: Model Predictive Control (MPC) relies on solving constrained optimisation problems online, in real time, to compute the next control signal. The solution time is often the bottleneck preventing application of MPC in a particular domain. I will present 3 new directions we are exploring for MPC, two of which are aimed at easing this bottleneck. The third is aimed at intelligent control allocation in over-actuated systems. The first and third of these will use techniques familiar to the Signal Processing community. The 3 directions are: (1) Use of Sequential Monte Carlo methods, implemented on GPU hardware, to solve non-convex problems reliably and quickly, with application to air-traffic management. This is similar to Particle Filtering. (2) The use of 'generalised blocking' to reduce the degrees of freedom in the optimisation problem when long planning horizons are required. (3) Using L_1 regularisation to induce 'sparse' solutions which preferentially use selected actuators, while leaving others idle most of the time. This is similar to LASSO regression for sparse estimation.