Exponential turnpike and sensitivity analysis for general linear evolution equations

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In this talk we consider linear quadratic optimal control problems governed by general evolution equations with bounded or admissible control operator. We first explain why the analysis of sensitivities and turnpike behavior is important, e.g., for the analysis and efficient numerical implementation of model predictive control schemes. We then show that if the problem is stabilizable and detectable, the solution of the extremal equation can be bounded by the right-hand side including initial data with the bound being independent of the time horizon. Consequently, the influence of perturbations of the extremal equations decays exponentially in time. Based on this result, an exponential turnpike property for unbounded but admissible control of general semigroups can be deduced. This result is remarkable, because alternative proof techniques for turnpike properties based on Riccati equations do not work for this general class of equations. We finally illustrate these theoretical results by a couple of simulations.