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SOLUTION OF LINEAR QUADRATIC CONSTRAINT PROBLEM VIA COORDINATING APPROACH

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Abstract. *In this paper the continuous time linear quadratic control problem with states and/or control constraints is considered. A novel approach is developed to solve this problem using large scale system concepts. In this respect, a coordinating variable is created on which state constraints are applied. Under the assumption that the problem has a solution, at the end of convergence, system constraints as well as dynamics are satisfied and the optimal solution is obtained. The convergence behavior of the proposed procedure is rigorously studied. Illustrative examples are solved to show the applicability of the developed technique.*

Keywords: Large scale systems, Constrained linear quadratic problem, Computational algorithm

1. **Introduction.** From a practical point of view, most control systems are subject to limitations on states and/or controls due to physical constraints. This problem is challenging and has attracted many researchers specially for linear time invariant discrete systems.

Previously, this problem has been tackled using time decomposition and multilevel algorithms [1,2]. During the last decade, two different approaches have been proposed to solve this problem [3-8]. In the first approach, a nonlinear control design methodology is used which explicitly takes into account constraints in the design phase and leads to control strategies that ensure, within given conditions, closed loop stability and fulfillment of constraints. Within these approaches, stabilization of linear systems under input saturation have been presented in [6] via gain scheduling Algebraic Riccati Equation (ARE). Solving regulation and tracking problems in the presence of constraints is also handled via Linear Matrix Inequality Technique [5]. Model predictive control (MPC) has been also used to solve such a problem [4,5].

In the second approach, the command provided by a nominal linear controller is modified online to prevent constraint violation. Anti-windup [7,10,11] and command governor [8] methods are examples of this approach.

Although the constrained linear quadratic discrete time systems have attracted much research, only limited work has been done for the continuous time systems [12-14]. This is