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ENLARGING ELLIPSOIDAL INVARIANT SETS FOR CONSTRAINED LINEAR SYSTEMS

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Abstract. *The paper is devoted to the stabilization of linear systems having restricted states and controls in both cases of discrete time and continuous time. The determination of a large region of attraction for these systems is addressed. Necessary and sufficient LMI conditions are given for the derivation of state-feedback controllers driving the system asymptotically to the origin without violating the constraints. Moreover, a numerical algorithm is provided for the enlargement of the volume of the attraction region and compared to previous similar works. The approach is illustrated by some numerical examples.*

keywords: Domain of attraction, Invariant ellipsoid, State constraints, Control constraints, Linear Matrix Inequalities

1. **Introduction.** The regulation of constrained systems is becoming an increasingly important topic in control theory. In practice, the constraints are inherent to any kind of physical or chemical or real process and may arise from physical limitations on the process or may depend on its nature. In industry, for example, one can impose or have: maximum flow for valves, limitations on voltages and currents in electrical processes, limitations on pH and concentrations in chemical processes, etc. Henceforth, constrained systems are connected to a wild spread of applications and their study is of continuing interest in the control community.

Numerous approaches have been proposed for linear systems involving constraints, see for example (without having been exhaustive) [3-10,18,23-27]. Most of the approaches deal with saturated controls, as the small and high gain concept [22] and the l_1 concept [13]. Other general methods have been derived by applying the absolute stability analysis tools, such as the Circle and Popov Criteria, where the saturation is treated as a locally sector bounded nonlinearity and the domain of attraction is estimated by using quadratic and Lur'e type Lyapunov functions [16,26]. Since the work of [14], many works focused on the characterization of the maximal set of attraction for constrained linear systems.