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USE OF CANONICAL FORMS TO ACHIEVE ASYMPTOTIC FEEDBACK CONTROLLABILITY OF SWITCHED CONTROL SYSTEMS

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A switched system is a hybrid dynamical system consisting of a family of continuous-time subsystems and a rule that describes how the subsystems switch among them. Switching among different system structures is an essential feature of many engineering applications such as power systems. Furthermore, switched control systems have numerous applications in control of mechanical systems such as aircrafts and satellites.

The class of continuous-time time-invariant controllable linear systems can be stabilized by means of controller canonical forms. Such canonical forms are not known in the context of switched control systems since a simultaneous transformation of two linear systems is not straightforward. Here, our attention is focused in developing such canonical forms for the controllable switched systems consisting of two continuous-time time-invariant linear subsystems. In this research, the transformation matrices are constructed by arranging the suitably chosen basis vectors of the state space of the relevant switched system as columns. Moreover, the existence and uniqueness of such canonical forms are established.

These canonical forms are then used to devise switching strategies that guarantee asymptotic feedback controllability of switched control systems, and this process can briefly be explained as follows. First, using the canonical forms, a manifold M which contains the origin of the state space of the switched control system is constructed. Then, the state is steered to the Manifold M from an arbitrary initial state $x(0)$ in the state space in finite time. Finally, the state is asymptotically driven to the origin without leaving M.

The type of canonical forms developed in this work guarantees the robustness of the aforementioned process. The canonical forms developed in this work enable us to devise the switching strategy for the aforementioned process due to the appearance of 'zeros' and 'ones' in the appropriate positions. Moreover, an upper bound for the number of switchings can be estimated by use of the canonical forms established in this work.

As future work, the canonical forms of the switched control systems consisting of more than two subsystems can be developed. To achieve this, one may need a better understanding of the topological structure of the switched systems consisting of continuous-time time-invariant linear subsystems. Thus, the complete investigation of the topological structure of such systems should be carried out in order to obtain canonical forms in the general case.