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POLE LOCATION CLUSTERING FOR UNCERTAIN DESCRIPTOR SYSTEMS WITH PERTURBED DERIVATIVE MATRICES

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Abstract. *This paper mainly investigates stability analysis and pole location in a prescribed region for the uncertain descriptor system which is subjected to parametric uncertainties in both the derivative matrix and the system matrix. Equivalent stability and pole location criteria for the nominal descriptor system are firstly derived. By involving the uncertainties, we further address the robust stability and the robust pole location for the regarded uncertain systems. Since some of these conditions are expressed in terms of nonstrict or complex linear matrix inequalities (LMIs), we thus utilize a convex programming algorithm, a projection method, for numerical verification. Based on some defined convex sets, the corresponding projection operators can be derived. Then, an analyzing algorithm is proposed for evaluating feasible solutions. Illustrative examples demonstrate that the proposed approach is valid and effective.*
Keywords: Descriptor systems, Robust stability, Pole location, Linear matrix inequality (LMI)

1. **Introduction.** The descriptor systems can describe a wider class of systems, including physical models and nondynamic constraints, and they are also referred to as singular systems, implicit systems, generalized state-space systems, differential-algebraic systems or semi-state systems [1-4]. Recently, robust stability and robust stabilization for uncertain descriptor systems have been considered [5-11]. The corresponding stability issue is more complicated than the traditional state-space system (regular system), because it requires considering not only stability robustness, but also regularity and impulse immunity simultaneously. The aforementioned works are all deduced from a fixed or constant derivative matrix E. For modeling descriptor systems from real systems, if the perturbed uncertainties exist in a structure or behavior, they are usually related not only to the system matrix but also to the derivative matrix. Only few works [12,13] address the robust stability or the robust stabilization for the descriptor systems with the uncertain derivative matrix. And, their results must put some restrictions on the perturbed derivative matrix to satisfy specific forms.

Nevertheless, the stability is only a minimum requirement for control systems. Pole location in a prescribed region is one of the important specifications for the dynamic systems, which can be referred to the system's performances: decay rate, damping and the transient behavior of the states. Therefore, pole locations in specific regions, e.g., shift half-planes, vertical/horizontal strips, sectors, parabolic regions and any intersection thereof, for the regular system has been developed in many works [14-19]. Recently, the pole location in a prescribed complex plane for the descriptor system is investigated