# Descriptor systems controller, with minimizing the norm of state feedback matrix

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**Abstract**

In this paper, we describe the similarity transformation of the state space of a descriptor system and then using state-derivative feedback. Then we determine parametric state feedback matrix for a linear descriptor system. First, we define the input as a multiple of the state-derivative feedback, and when the descriptor system was changed a standard system with state feedback, consider that the similarity transformations. Using the system closed-loop matrix graph, we find the parametric state feedback matrix. Finally we get the controlled optimal matrix with minimum norm.

**Keywords:** Descriptor system, State-derivative feedback, Closed-loop matrix graph
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## 1 Introduction

Minimum norm of feedback matrix in controllable descriptor systems in recent years have had a favorable and certain effect on types of human life. Many researcheres have performed extensive amounts of researches on eigenstructure assignment in descriptor system like Bunse (1992), Duan and Wang (2005) in [1, 2]. Many authors like Karbassi and Bell worked on minimization of the norm of feedback controllers, too [3, 4, 5, 6, 7].

The first advantago of this paper is, using the state-derivative feedback to convert the descriptor to a standard system. Then using similarity transformation and parameterization, we transform the state space will facilitate the calculation of the system feedback matrix and the feedback matrix using graph theory. Also, by identifying the parameters location of the feedback matrix, we can count them in their numbers. The most important superiority of this paper is that, makes it possible to calculate the state space similarity transformation and parametric state feedback matrix for a descriptor system.

In this paper it is assumed that the descriptor system (1) is a linear time-invariant system with state-derivative feedback (2). First we convert the descriptor system (1) with (2) to standard system (5b) with state feedback control (5c), then we obtain state feedback matrix for assigning desired eigenvalues to system (5b), finally we obtain minimum norm of state feedback controller. Consider a controllable linear descriptor system described by

$$E\dot{x}(t) = Ax(t) + Bu(t), \quad x(0) = 0 \tag{1}$$

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