

# Canonical transformation and feedback linearization of state-dependent coefficient nonlinear systems

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**Abstract:** This report is devoted to a feedback linearisation problem for a nonlinear system with state-dependent coefficients:

$$(1) \quad \dot{x}(t) = A(x)x + B(x)u, \quad x(0) = x_0, \\ x \in R^n, \quad u \in R^1.$$

Here  $A(x), B(x)$  are state-dependent matrices of the dimensions  $n \times n, n \times 1$  correspondingly.

The problem is to find a non-singular similarity transformation  $z = T(x)x$  such that the system (1) can be transformed to a quasi-linear canonical form

$$(2) \quad \dot{z}(t) = A_c(z)z + B_c(z)u, \quad z(0) = z_0,$$

where  $A_c(z), B_c(z)$  is a canonical pair in the form of Brunovski. This canonical transformation significantly simplify feedback linearization problem for transformed system (2), and knowing the inverse transformation  $x = T^{-1}(z)z$ , one can obtain a feedback linearization control for original system (1).

There are several techniques for designing such canonical transformation [1,2]. In this paper we introduce another approach based on the concept of state-dependent transfer function and controllability matrix for nonlinear system (1).

**Keywords:** state-dependent coefficient, nonlinear system, feedback linearisation, canonical transformation

**2010 Mathematics Subject Classification:** 35J05, 35J08, 35J25

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