Feedback linearizability in the class C^1

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A control system $\dot{x} = f(x, u)$ is called feedback linearizable if it is reduced to a linear form $\dot{z} = Az + Bv$ by some change of variables $z = F(x)$ and a control $v = g(x, u)$. First results in the field were obtained in 1973. Namely, V. I. Korobov [1] introduced a special class of nonlinear systems ("triangular systems") which were feedback linearizable. These studies were originated by satellite control problems. Within this approach, triangular systems of the class C^1 were treated. On the other hand, A. Krener [2] considered the linearizability for affine systems of the class C^∞ by use of the Lie algebraic technique. Later, the linearizability problem in the class C^∞ was completely studied by B. Jakubczyk and W. Respondek [3] and other authors.

In [4] affine systems $\dot{x} = a(x) + b(x)u$ were considered where $a(x), b(x)$ are of the class C^1. It turned out that in this case the feedback linearizability conditions for systems of the class C^∞ [3] are neither necessary nor sufficient. The new ideas were proposed inspired by the original technique of triangular systems. In particular, it was proposed to use some other vector fields instead of Lie brackets which may not exist in the class C^1. In the talk we give an overview of the results of [4] and their further development [5]–[7].

[1] Korobov V. I. Controllability, stability of some nonlinear systems // Differ. Uravn. – 1973. – 9. – pp. 614-619 (Russian); English transl.: Differential Equations. – 1975. – 9. – pp. 466-469.

[2] Krener A. On the equivalence of control systems and the linearization of non-linear systems // SIAM J. Control. – 1973. – 11. – pp. 670-676.

[3] Jakubczyk B., Respondek W. On linearization of control systems // Bull. Acad. Sci. Polonaise Ser. Sci. Math. – 1980. – 28. – pp. 517-522.

[4] Sklyar G. M., Sklyar K. V., Ignatovich S. Yu. On the extension of the Korobov's class of linearizable triangular systems by nonlinear control systems of the class C^1 // Systems and Control Lett. – 2005. – 54. – pp. 1097-1108.

[5] Sklyar K. V., Ignatovich S. Yu. Linearizability of systems of the class C^1 with multi-dimensional control // Systems and Control Lett. – 2016. – 94. – pp. 92-96.

[6] Sklyar K. V., Ignatovich S. Yu., Sklyar G. M. Verification of feedback linearizability conditions for control systems of the class C^1 // Proceedings of the 25th Mediterranean Conference on Control and Automation (MED), Valetta, Malta. – 2017. – pp. 163-168.

[7] Sklyar K. V., Sklyar G. M., Ignatovich S. Yu. Linearizability of multi-control systems of the class C^1 by additive change of controls // Operator Theory: Advances and Appl. – 2018. – 267. – pp. 359-370.