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FURTHER RESULTS ON ADVANCED CONTROL AND STABILITY ISSUES OF FRACTIONAL-ORDER DYNAMICAL SYSTEMS

Mihailo P. Lazarević[1]

[1] *Faculty of Mechanical Engineering, University of Belgrade, 11000 Belgrade, Serbia*

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ABSTRACT

Recently, fractional calculus has attracted the increased attention of scientific society where fractional operators are often used for complex dynamical systems,[1]. Iterative learning control (ILC) is one of the recent topics in control theories and it is a powerful intelligent control concept that iteratively improves the behavior of processes that are repetitive in nature. Here, we present recently obtained results as well as new results on open-closed loop type ILC, [3-5] for a given class of integer order and fractional order regular systems. We discuss PIDD^2/ PID, PD^{2}D$^\alpha$,PD$^\alpha$/PD types ILC, particularly ILC schemes with D type which is more flexible for practical implementation. Sufficient conditions for the convergence in the time domain of the proposed ILC for a class of fractional and integer order systems are given by the corresponding theorems together with its proof. Finally, the simulation results, including an application to the suitable robot system and Neuro-Arm robot, are presented to illustrate the performance of the proposed ILC schemes.

Also, some attention will be devoted to the finite-time stability/stabilization problem of fractional-order (uncertain) neutral time-delay systems. By use of the generalized Gronwall inequality and its extended form, new sufficient conditions for finite-time stability of such systems are obtained. Finally, numerical examples are given to illustrate the effectiveness and applicability of the proposed theoretical results.

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