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RECURSIVE 4SID-BASED IDENTIFICATION ALGORITHM WITH FIXED INPUT-OUTPUT DATA SIZE

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Abstract. *The 4SID method belongs to a class of identification methods which determine unknown system parameters as well as system order from input and output data. Assuming that the mathematical model of unknown system is described by a discrete-/continuous-time time-invariant state space linear system, several 4SID-based algorithms have been developed up to now; however, most of these seem to point batch processing. Recursive algorithms are urgently expected from the viewpoint of reducing computational burden and storage cost. In this paper, a new recursive 4SID-based algorithm is derived by keeping the size of input and output data to be constant. Its derivation is direct and rather simple compared with any other recursive ones, and the algorithm is called the bona fide recursive algorithm. Efficiency of the algorithm is demonstrated by comparing numerical results with that obtained by existing methods.*
Keywords: Subspace identification, Recursive algorithm, Identification algorithm, Stochastic system

1. **Introduction.** During the last two decades, subspace-based system identification (4SID) methods have attracted a great deal of interest in control community and been particularly developed (e.g., [1-3]), because they can identify system matrices of the state space model directly from the input and output data. The primary surge of interest has been concentrated mainly on the time-invariant linear systems. In reality, however, most existing systems show time-varying and/or nonlinear behavior. The nonlinear systems are sometimes treated as higher-order linear time-varying systems from the practical point of view. As well known, subspace methods are based on robust numerical tools such as LQ-factorization and singular value decomposition (SVD). Although these tools are appropriate for batch processing, they are inappropriate for on-line identification because of their computational burden and storage costs. From the standpoint of computational burden for such systems as mentioned above, on-line subspace identification consisting of recursive algorithm is intensely desirable.

So far, several challenging works have been done in deriving recursive subspace algorithms. As mentioned above the basic tools for subspace identification are the LQ-factorization and the SVD; so, in order to lighten the computational burden as well as

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