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PREFILTERING BASED ON WOLD'S DECOMPOSITION FOR LINEAR MIMO SYSTEM IDENTIFICATION

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Abstract. *In this paper, we present a prefiltering method for linear multi-input multi-output (MIMO) system identification. It is assumed that the system representation is the combined system with deterministic system and stochastic system based on orthogonal decomposition of the output process. The stochastic component can be defined clearly by the orthogonal decomposition of the output process based on the conception of Wold's decomposition. Therefore, we consider removing the stochastic component from the output process. If the stochastic component can be removed completely, by employing deterministic subspace methods, the parametrization problem included in the state-space model identification is completely bypassed. Also, if the stochastic component can be estimated precisely, this namely means a prefiltering for the system identification. For implementing this purpose, we employ LQ decomposition, also consider that the last block row of L-matrix is extracted. Also, the effectivities are shown in numerical experiments.*
Keywords: System identification, ORT method, Wold's decomposition, LQ decomposition, Prefiltering, FIR filter

1. **Introduction.** In linear MIMO system identification based on the state-space model, to seek a minimal parametrization is known as a difficult problem [1]. For the problem, there are the methods that canonical forms and full-parametrization are used, or that is based on data driven local coordinates (DDLC) and prediction-error method [2, 3]. In particular, the latter approach attracts attention in recent years since on the optimal procedure, DDLC reduces the search space to the minimal dimension, and is numerically stable compared with the former. On the other hand, as the method that can avoid the parametrization problem, there are subspace methods. However, subspace methods have some disadvantages, e.g. such that the statistical properties of the estimated parameters are not obscure. In addition, although N4SID [4] and MOESP [5] are typical as subspace methods, they cannot strictly fit the experimental condition that the noise of more wide class is involved in the object system, such that is dealt in this paper.

In this paper, we present a prefiltering method for implementing the identification that is robust for the presence noises and that the above-mentioned parametrization problem is bypassed. It is assumed that the system representation is the combined system with deterministic system and stochastic system based on orthogonal decomposition of the output process. Then, our purpose is to remove the stochastic component well-defined by the conception of Wold's decomposition [6] from the observable output process, this namely means to obtain the output process of deterministic system. If the deterministic output process is obtained absolutely, e.g. by employing deterministic subspace methods [4, 7], the parametrization problem is completely avoided, and consequently very precise model can be derived. Also, if the deterministic output process is estimated precisely,