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Identifiability, recursive identification and spaces of linear dynamical systems, (2 volumes)

CWI Tracts 63 and 64, Centre for Mathematics and Computer Science, Stichting Mathematisch Centrum, Amsterdam, 1989, 413 pages.

This is a rather abstract treatment of the identification problem for linear dynamical systems. The author is influenced by work of J. Willems, M. Hazewinkel and S. Marcus. This book contains the result of work that has been done in collaboration with the latter two during the period 1979-1984.

After an introductory chapter, the book starts with chapter two where the systems, stochastic as well as deterministic, are defined and their various representations are discussed. The partial realization problem for arma models is discussed in chapter three. For the stochastic case you find here the relation with the finite identifiability problem, which stems from econometrics.

The last three chapters are different from the previous ones in that they rely heavily on topological concepts and results in differential geometry. Chapter four gives an overview of known results in this kind of study. Central is the notion of a fibre bundle. This represents a family of systems, each fibre is one system and each point on the fibre corresponds to a certain state.

In chapter five, the model space is provided with a metric, in fact two metrics (inner and outer metric). The most practical metric turns out to be a Riemannian metric, which is defined locally as an inner product metric in the tangent space of the differentiable manifold. This manifold is for example the set of all systems of fixed McMillan degree.

The last chapter is rather long. It makes up the complete second volume. It discusses gradient (in the Riemannian metric) algorithms for recursive identification of stochastic systems where the model set is a differentiable manifold.

This book is an advanced treatment of the problem that contains many new results and improvements of published results. The specialist will benefit from its reading.

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