

## ON INFINITE DIMENSIONAL DISCRETE TIME PERIODICALLY CORRELATED PROCESSES

A.R. SOLTANI AND Z. SHISHEBOR

**ABSTRACT.** Periodically correlated processes with values in Hilbert spaces are introduced and studied. The harmonizability of such a process is discussed. The covariance operator is characterized. Time-dependent spectra on Hilbert spaces are introduced and a time-dependent spectral density for a periodically correlated process is given.

**1. Introduction.** *Periodically correlated, PC* in short, sequences, introduced and studied first by Gladyshev in 1961, have recently received tremendous attention from different authors. This is due to a variety of applications of this class of nonstationary processes in different areas of sciences and engineering. The works of Hurd, Miamer and Salehi, among others (see the references), have elaborated the theory of periodically correlated processes. The book of Gardner [3] provides a good view on the applications of the *PC* processes in different branches of engineering and physics. Most of the works on the *PC* processes are confined to one-dimensional *PC* processes. The multi-dimensional processes, to the best of our knowledge, have not yet been treated in good detail. This article studies the *PC* sequences with values in a Hilbert space. The harmonizability, the structure of the covariance and the existence of a time-dependent spectral density are topics which are furnished in this article. The article brings the authors' works in [18, 19] to the contents of probability theory, together with a new perspective on the structure of the covariance function. The approach to spectral representation, presented in this article, is different from the one employed by Gladyshev, 1961, which was via forming a correlation matrix, and also from the one employed by Hurd, 1989, which was via using a certain root of a unitary operator. For recent works on *PC* processes, see [10, 17].

---

2000 AMS *Mathematics Subject Classification.* Primary 60G12, 60G57.

*Key words and phrases.* Spectral representation, infinite dimensional processes, periodically correlated processes.

Received by the editors on Sept. 16, 2004, and in revised form on Feb. 2, 2005.

Copyright ©2007 Rocky Mountain Mathematics Consortium