# TIME SERIES PREDICTION USING CONVOLUTION SUM DISCRETE PROCESS NEURAL NETWORK

*Ding Gang, Lei Da, Zhong Shisheng**

**Abstract:** A convolution sum discrete process neural network (CSDPNN) is proposed. CSDPNN utilizes discrete samples as inputs directly and employs convolution sum to simulate the process inputs so as to deal with the time accumulation existing in many time series. Without the procedures of fitting the discrete samples into continuous functions to generate inputs and then to expand the input functions by basis functions, CSDPNN is better understandable and is with less precision reduction compared with process neural network (PNN) with function inputs. The approximation capacity of CSDPNN is analyzed in this paper, and it proved that CSDPNN can approximate PNN and has approximation capacity not worse than traditional artificial neural network (ANN). Finally, CSDPNN, PNN and ANN are utilized to predict the Logistic chaos time series and the iron concentration in the lubrication oil of aircraft engine, and the application test results indicate that CSDPNN performs better than PNN and ANN given the same conditions.

Key words: *Process neural network, functional approximation, time series prediction, aeroengine health condition monitoring,*

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## 1. Introduction

Time accumulation effect widely exists in practical systems, which leads to the fact that the systems' responses not only depend on the instantaneous inputs but also rely on the inputs before the instantaneous moment. In other words, responses of such systems are time-depending processes. HE proposed the process neural network (PNN) which has the ability to deal with the time varying process so as to handle such problems [6]. PNN has a similar structure with the traditional artificial neural network (ANN), and is composed of weights, aggregate and activation, but the aggregate operation unit of PNN contains spatial aggregate operation and time aggregate operation, where the time aggregation operator deals with the time varying process. Taking the advantages of processing time accumulation effects,

*Ding Gang – Corresponding Author, Lei Da, Zhong Shisheng, School of Mechatronics Engineering, Harbin Institute of Technology, Harbin 150001, P.R.China Phone: (+86)139 4609 2735, E-mail: dingganghit@163.com

 