Program Book and Abstract Proceedings

INTERNATIONAL CONFERENCE ON MODELING AND SIMULATION 2006 (MS2006)

3 - 5 April 2006
Cititel Mid Valley
Kuala Lumpur Malaysia

Paper Code: 152

COMPARISON OF MULTIPLE REGRESSION ANALYSIS AND ARTIFICIAL NEURAL NETWORK FOR MODELING OF Nd:YAG LASER CLADDING

K.R.Balasubramanian[1], K.Sankaranarayanasamy[2] and G.Buvanashekaran[3]
[1,2] National Institute of Technology, Tiruchirappalli 622 015, India
[3] Welding Research Institute, BHEL, Tiruchirappalli 622 014, India
[1] k_r_bala@yahoo.com, [2] ksnsamy@nitt.edu, [3] gbs@bheltry.co.in

ABSTRACT - Modeling of cladding is important for advancing the knowledge on the mechanics of materials processing. In laser cladding, for an effective control of the laser input and output parameter, modeling is an appropriate tool. In fabrication industries, intelligent material processing requires precise and consistent output in order to meet the quality standards. In this study, modeling was done using both artificial neural network and multiple regression analysis. Comparison was made between artificial neural network and multiple regression analysis to predict which one is the best for modeling of laser cladding. Medium carbon steel has been selected for the laser cladding trials. A 2kW Nd:YAG laser system available at Welding Research Institute, Bharat Heavy Electricals Limited, Trichy, India, was used for the experimental studies. Laser beam power, clad speed are the major input parameters having significant effects on the main output parameters, clad height and depth of dilution which controls the structural integrity of the cladded layer. The laser-cladded samples were metallographically prepared to record the output parameters. Experimental data was trained using feed forward neural network with back propagation learning method, available as a tool in MATLAB. Number of simulations was carried out with varying number of hidden layers, neurons, different goal settings and transfer functions. The computed data was compared with the measured data for verification and evaluating the percentage of error of the proposed ANN solution. The regression analysis on the experimental data was conducted using the statistical software SPSS 8.0. It has been observed that compared to the multiple regression analysis, the artificial neural network modeling is a more accurate system for modeling to predict the clad height and depth of dilution.
Keywords: Laser cladding Pre-placed powder, carbon steel, Neural Network modeling, multiple regression analysis, depth of dilution, clad height

Paper Code: 156

STEAM BATCH FLUIDIZED BED DRYERS MODELING BY RECURRENT NEURO-FUZZY NETWORKS

M. Mohammadzaheri[a], A. Mirsepahi[b], M.T. Hamed Mosavian[c]
Islamic Azad University- Semnan[a] ,Ferdowsi University of Mashad[b,c]
Corresponding author[a] ,Student[b]
mmzahery@gmail.com

ABSTRACT - In current paper, a modeling technique for time-series modeling is presented and applied for batch fluidized bed dryer. In this method, a neuro-fuzzy network is constructed based on dryer specifications and then is trained by recorded data. A neuro-fuzzy network can be translated to fuzzy inference system (FIS). Trained neuro-fuzzy networks (FIS's) are checked by experimental data completely apart from training data. The achieved accuracy is very high, and as a significant result, the nature of the system can be expressed in fuzzy rules which are mainly formed by linguistic variables. Since dryers are dynamic systems, recurrent (dynamic) neuro-fuzzy networks are used for modeling. Steam batch dryer's behavior is relatively complicated. Initially, moisture content of drying material increases because of the absorption phenomenon, and then the moisture decreases with an approximately high and fixed slope, then at the third stage, the slope of drying reduces significantly. In this research, despite classical methods, only one neuro-fuzzy network is constructed and trained for all of operating conditions.
Keywords: Fuzzy Logic, Fluidized bed dryer, Neuro-fuzzy modeling, Food industry

Paper Code: 192

CONTROL OF NEUTRALIZATION PROCESS USING NEURAL NETWORKS

*N.Sivakumaran, S.Nagammai, P.Karthikeyan and T.K. Radhakrishnan**
Department of Chemical Engineering,
National Institute of Technology,
Tiruchirappalli-620015. *radha@nitt.edu

ABSTRACT - The pH neutralization is of significant industrial importance. The process exhibits severe static non-linear behavior and complex dynamic characteristics. The static non-linear part is modeled using feed forward neural network trained with gradient descent back propagation algorithm. The Network architecture is selected using the Akaike Information Criteria. The network is trained with input-output data, which is generated by pseudo-random binary sequence, and the network is validated with another set of data. In this paper, Wiener model based PI controller and Hammerstein model based PI controller based on feed forward neural networks is developed and are compared with linear PI controller. The performances of these controllers are compared based on the loss functional values for step changes in the set point and load disturbance for the various values of pH. From the results, Wiener model based PI controller is a suitable controller for Neutralization Process.
Keywords: Neutralization, Back propagation, information Criteria and Neural networks

Paper Code: 7

DESIGN OF MULTI WAVELET NETWORK IDENTIFIER FOR MULTI INPUT MULTI OUTPUT NONLINEAR FUNCTIONS

Prof. Dr. Waleed A. Mahmoud[1] and Dr. Yhya R. Kuraz[2]
1.Department of Electrical Engineering
University of Baghdad
2.Department of Computer Engineering
University of Mosul, Iraq
yhya_kuraz@yahoo.com

ABSTRACT - A proposed multi wavelet network are used in identification problems of nonlinear systems. A multi wavelet network is constructed as an alternative to a neural network to approximate a nonlinear system. Based on this multi wavelet network approximation, suitable for multi input multi output nonlinear uncertain (or unknown) functions such as robot manipulator.
Keywords: wavelet network, neural network, multi wavelet, multi wavelet network, identification and multi input multi output systems.

Paper Code: 193

MODELING AND ROBUST CONTROLLER DESIGN FOR MULTIVARIABLE PROCESS

*N.Sivakumaran, V.Kirubakaran, and T.K. Radhakrishnan**
Department of Chemical Engineering,
National Institute of Technology,
Tiruchirappalli-620015. *radha@nitt.edu

ABSTRACT - Most of the industrial processes are multivariable in nature. The quadruple tank process with non-linear dynamics is studied and implemented in real time. The linearized dynamics of the non-linear system may have a multivariable zero that can be moved along the real axis by changing the ratio of flow using a valve. The zero can be made to shift between both the left and the right half of the s-plane. Thus, the four-tank process is ideal for illustrating many details in multivariable process and its control, particularly, giving importance to performance limitations due to the multivariable right-half plane (RHP) zeros, which can be varied. The performance comparison based on Integral Square Error (ISE) for inner outer factorization based on robust internal model controller with decentralized robust PI controllers and H_∞ controller shows that the robust internal model controller designed by the inner outer factorization method is more suitable for the control of four-tank system.
Keywords: Multivariable, Right half plane and Robust Controller.

Paper Code: 240

ACTIVE VIBRATION CONTROL OF A FLEXIBLE SMART BEAM WITH PIEZOCERAMIC ACTUATORS AND POLE PLACEMENT CONTROLLER

J. Fei, Y. Fang
Department of Mechanical Engineering
University of Akron, Akron, OH 44325
Email: jtfei@ieee.org

ABSTRACT - This paper presents the pole placement control scheme for vibration suppression of a flexible structure using piezoceramic actuators. The PZT patches are bonded near the fixed end of flexible steel cantilever beam. The dynamic model of the flexible steel cantilever beam is derived. The pole placement controller is experimentally verified on a flexible beam using xPC Target real-time system, showing that it has satisfactory performance in vibration suppression. Experimental results demonstrate that the proposed methods achieve effective vibration suppression results.
Keywords: pole placement control, vibration suppression, piezoceramic actuators