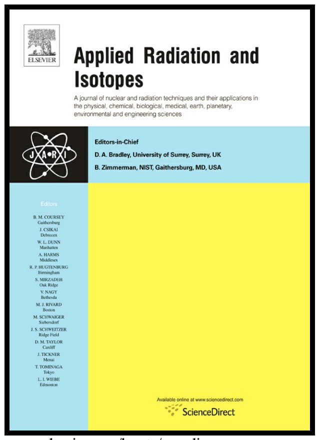

www.elsevier.com/locate/apradiso

A novel method for flow pattern identification in unstable operational conditions using gamma ray and radial basis function

G.H. Roshani, E. Nazemi, M.M. Roshani

PII: S0969-8043(16)30613-3
DOI: http://dx.doi.org/10.1016/j.apradiso.2017.02.023
Reference: ARI7794

To appear in: *Applied Radiation and Isotopes*

Received date: 26 August 2016
Revised date: 14 February 2017
Accepted date: 14 February 2017

Cite this article as: G.H. Roshani, E. Nazemi and M.M. Roshani, A nove method for flow pattern identification in unstable operational conditions usin gamma ray and radial basis function, *Applied Radiation and Isotopes* http://dx.doi.org/10.1016/j.apradiso.2017.02.023

A novel method for flow pattern identification in unstable operational conditions using gamma ray and radial basis function

G. H. Roshani[1], E. Nazemi[2,*], M. M. Roshani[2]

[1] Electrical Engineering Department, Kermanshah University of Technology, Kermanshah, Iran.

[2] Young Researchers and Elite Club, Kermanshah Branch, Islamic Azad University, Kermanshah, Iran.

[*]Corresponding author: Tel: +989132007423. enazemi@aeoi.org.ir

Abstract

Changes of fluid properties (especially density) strongly affect the performance of radiation-based multiphase flow meter and could cause error in recognizing the flow pattern and determining void fraction. In this work, we proposed a methodology based on combination of multi-beam gamma ray attenuation and dual modality densitometry techniques using RBF neural network in order to recognize the flow regime and determine the void fraction in gas-liquid two phase flows independent of the liquid phase changes. The proposed system is consisted of one ^{137}Cs source, two transmission detectors and one scattering detector. The registered counts in two transmission detectors were used as the inputs of one primary Radial Basis Function (RBF) neural network for recognizing the flow regime independent of liquid phase density. Then, after flow regime identification, three RBF neural networks were utilized for determining the void fraction independent of liquid phase density. Registered count in scattering detector and first transmission detector were used as the inputs of these three RBF neural networks. Using this simple methodology, all the flow patterns were correctly recognized and the void fraction was predicted independent of liquid phase density with mean relative error (MRE) of less than 3.28%.

Keyword:

Radial basis function, Neural network, Flow pattern recognition, Density independent, Multi beam gamma ray.

1. Introduction

It is well known that gas-liquid two-phase flow is frequently encountered in a large number of industrial applications, such as boilers, core and steam generators in nuclear reactors, petroleum