REAL-TIME DETERMINATION OF PHASE TRANSPORT CHARACTERISTICS IN BUBBLY PIPE FLOWS WITH ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

THE PHASE TRANSPORT PHENOMENON OF THE HIGH-PRESSURE TWO-PHASE TURBULENT BUBBLY FLOW INVO -LVES COMPLICATED INTERFACIAL INTERACTIONS OF THE MASS, MOMENTUM, AND ENERGY TRANSFER PROC -ESSES BETWEEN PHASES,REVEALING THAT AN ENORMOUS EFFORT IS REQUIRED IN CHARACTERING THE LI -QUID GAS FLOW BEHAVIOR. NONETHELESS, THE IMMEDIATE INFORMATION OF BUBBLY FLOW CHARACTERIS -TICS IS OFTEN DESIRED FOR MANY INDUSTRIAL APPLICATIONS. THIS INVESTIGATION AIMS TO DEMONS -TRATE THE SUCCESSFUL USE OF NEURAL NETWORKS IN THE REAL-TIME DETERMINATION OF TWO PHASE FLOW PROPERTIES AT ELEVATED PRESSURES. THREE BACK-PROPAGATION NEURAL NETWORKS,TRAINED WITH THE SIMULATION RESULTS FROM LIU'S EXPERIMENTAL DATABASE AND COMPREHENSIVE THEORETICAL MODE -L,ARE ESTABLISHED TO PREDICT THE DISTRIBUTIONS OF VOID FRACTION AND AXIAL LIQUID/GAS VELO -CITIES OF UPWARD TURBULENT BUBBLY PIPE FLOWS AT PRESSURES COVERING 1 MPA AND 3.5 TO 7.0 M -PA.COMPARISONS OF THE PREDICTIONS WITH THE TEST TARGET VECTORS INDICATE THAT THE AVERAGED ROOT MEAN SQUARED ERROR FOR EACH ONE OF THREE BACK-PROPAGATION NEURAL NETWORKS IS WELL WIT -HIN 4.59 %. IN ADDITION, THIS STUDY APPRAISES THE EFFECTS OF DIFFERENT NETWORK PARAMETERS ,INCLUDING NUMBER OF HIDDEN NODES, TYPE OF TRANSFER FUNCTION, NUMBER OF TRAINING PAIRS,LEA -RNING RATE-INCREASING RATIO,LEARNING RATE-DECREASING RATIO, AND MOMENTUM VALUE,ON THE -TR AINING QUALITY OF NEURAL NETWORKS.

Keywords : NEURAL NETWORKS, BACK PROPAGATION, TWO-PHASE BUBBLY FLOW , PHASE DISTRIBUTION.

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