Conclusions

It was observed, that quantity of relative pitch has influence on the skewness coefficient value and for smaller relative pitch skewness has normal distribution in larger range of gas apparent velocity, than for bigger.

On the basis of the realized experimental investigation, it was found that DPIV techniques are effective and advanced implement helping in hydrodynamics flow evaluation.

It was observed too that, geometry configuration has influence on the two-phase gas-liquid flow in tube bundle space of heat exchanger.

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HYDRODYNAMICS OF PHENOMENA IN CO – CURRENT AND COUNTER – CURRENT TWO – PHASE GAS – LIQUID FLOW IN VERTICAL CHANNEL*

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In this article is presented the possibility to determine the limit between performing of co - current and counter – current two-phase gas - liquid flow in vertical channel as well as comparing of structures forming in both cases of the flow at applying methods utilizing levels of grey of registered images for recognizing of the image.

Introduction

Multiphase flows are important issue performing both in the nature and in the processing technology. The particular important area of multiphase flow in the two – phase gas – liquid flow in channels. It is occurring in very many disciplines of the technology, e.g.: in barbotage columns, at stirring or dividing of the gas and liquid, in evaporator multilayer apparatuses, in oil pipelines, in processes of the altered version of the crude oil, at evaporating and condensation in energy, chemical and cooling devices.

Two-phase gas – liquid flow can be realized both in horizontal and vertical channels. In vertical channels three cases are possible in terms of the direction of flow of both phases (liquid and gas):

- parallel current – gas and liquid flow upwards,

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- parallel current – gas and liquid flow downwards,
- counter current – gas flows upwards and liquid downwards.

Structure of the flow

During the flow of both phases, depending on the values of both streams, physical properties, measurements and shapes and location of the channel in which the flow occurs, various structures come into existence (Fig 1).

In the case of co - current flow the following structures could be distinguished:

a) bubbly - the liquid is occurring in the whole channel, the gas is flowing as the diffused phase in the form of bubbles,
b) lock - they are going by the channel locks surrounded with portions of the liquid which can be located small bubbles of the gas,
c) foam - the increased velocity of the gas is causing cracking of locks and the movement of the liquid and gas phase is growing oscillational and not-informed,
d) ring - the increased velocity of the gas is causing the shift of the liquid phase to the side of the channel while the gas is occupying his central part,
e) dispersed - he is occurring at the considerable velocity of the gas, the liquid is flowing in the form of drops suspended in the gas phase.

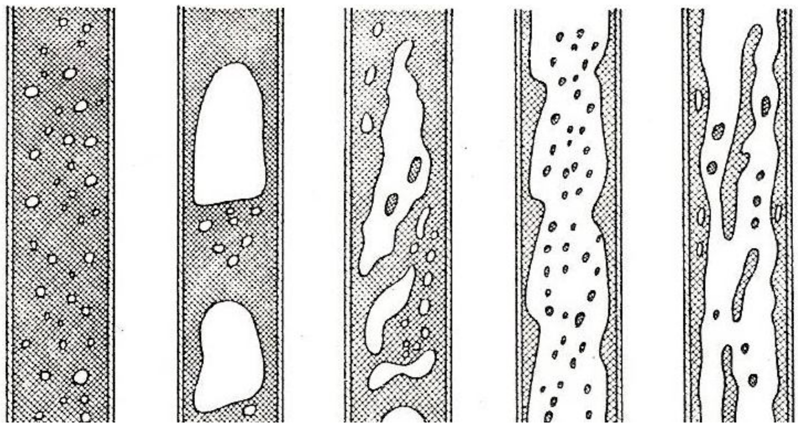

Fig.1. Flow structure in co – current flow: a). bubbly; b). lock; c). foam; d). ring; d). dispersed

The flow patterns in gas – liquid counter – current flow in vertical channels can be classified as shown in figure. The characteristics of each flow pattern are summarized as follows.

- Smooth film annular flow (SF),
- Disturbance wave annular film flow (DW),
- Turbulent wave annular film flow (TW),
- Slug flow (S) ,
- Liquid downflow (L),
- Flooding with partial film flow reversal (F),
- Flooding with wave breakup and entrainment (E),
- Flooding with wave bridging and disintegration (B),
- Hanging film (H),
- Gas upflow (G).

In conditions of the flow type G is occurring only co – current flow. He belongs however to underline that cases are existing when during the co - current flow the counter – current flow is occurring, who can have significant influence for incorrect work of industry sets requiring only the co – current flow.

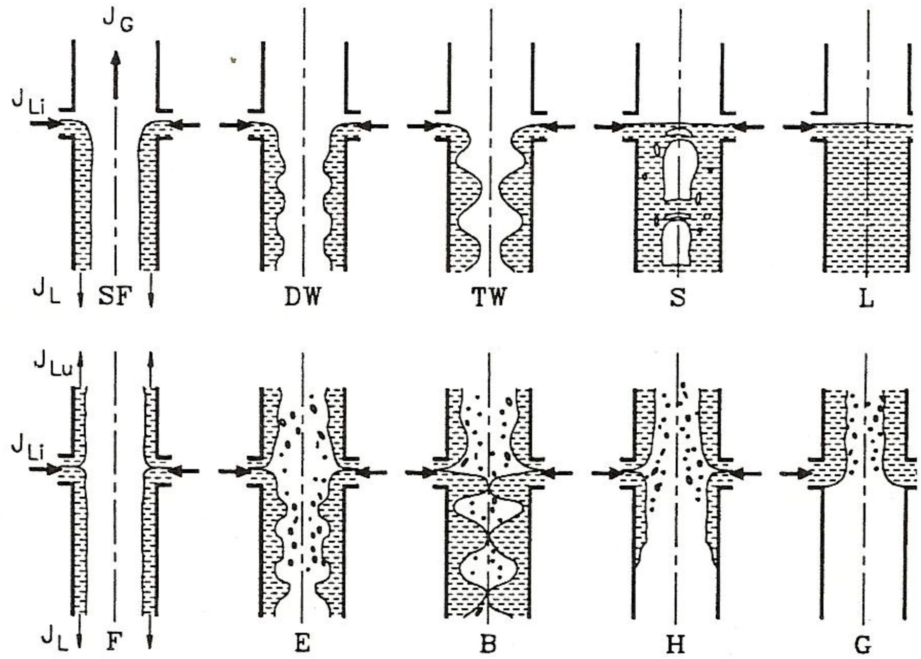

Fig. 2. Flow structure in counter – current flow

Test stand

In order to conduct an assessment of two-phase structure resulting from counter current flow of gas-liquid mixture a test stand has been designed. It consists of a vertical flow channel made entirely of transparent plexi-glass (polymetacrylane of methyl), thus enabling the recording of the flow structure. This channel is supplied from a mixture which originates from gas and liquid distributors. As a result of the application of visual based methodology of research the liquid was additionally dyed with methylene blue.

Depending on the streams of supplied phases the measuring channel may be applied in the observation of parallel current flow in the upward and counter current flow. The structure of flow has an important role in the formation of flow structures in the channel.

Methodology

In order to obtain information which they are making possible diagnosis of structures of the flow, registered images are remaining subjected to the analysis utilizing algorithms of recognizing of images. Changes of average values of grey levels are being analysed in the chosen zone of the channel in the function of the time. what is giving feasible grounds for plots making, possible to determine the flow structure performing during the two-phase gas - liquid flow at assumed streams both of phases.

The probability density function is the next tool necessary to determine the structure of the flow. This function is determining the possibility of the event relying on it, that values of the signal are included in the determined interval in the any moment.

The measuring channel was divided into 8 research areas, after 4 for the co – current and counter - current flow, whom average values of grey levels were being measured, giving feasible grounds for plots and applications to the probability density function.

Results of examinations

In the test stand they were being led examination when the gas velocity was between 1,4 – 9,7 m/s and the liquid velocity was between 0,3 – 2,2 m/s. The most often structures of the flow have been presented below.

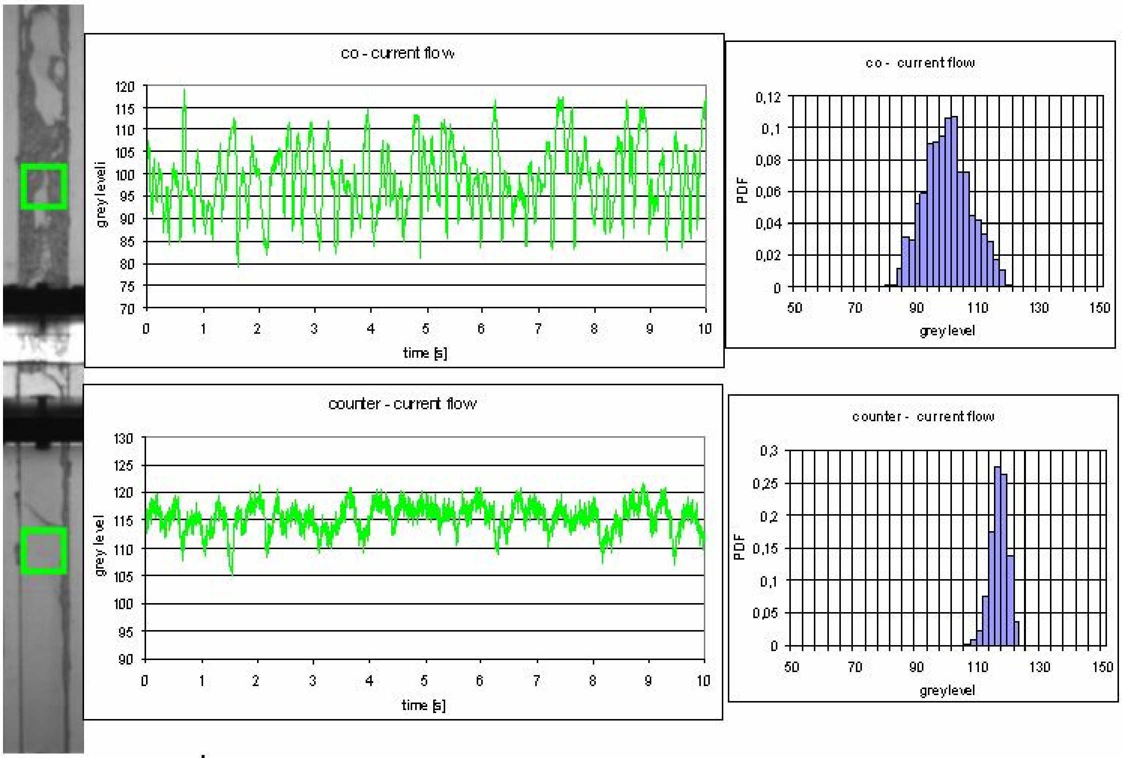

Fig. 3. Flow structure: foam in co – current flow and liquid downflow in counter – current flow

As shown in figure 3, the foam exists in co – current flow by gas velocity 1,4 m/s and liquid velocity 0,56 m/s, while in counter – current flow the liquid flows down.

By 5,6 m/s gas velocity and 1,7 m/s liquid velocity, both in co – current and counter – current flow is occuring the lock flow (Fig.4).

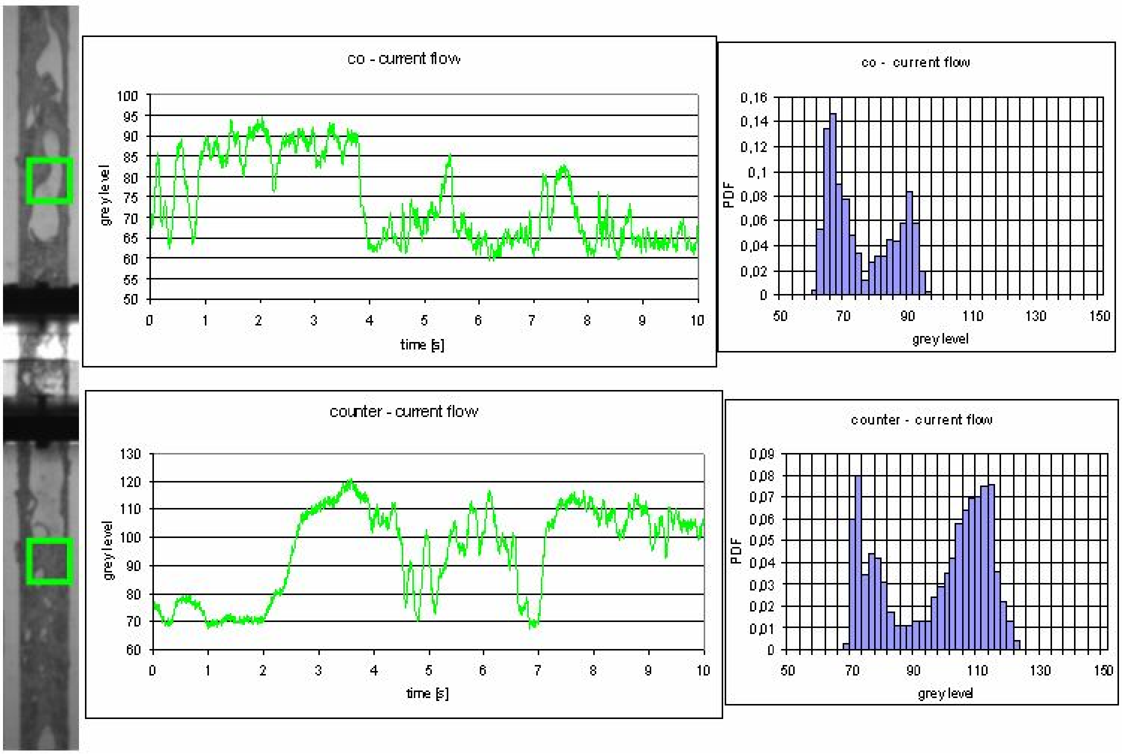

Fig. 4. Flow structure: lock in co – current and counter – current flow

Conclusion

At utilizing methods of recognizing of the image they made the specification of dissimilarities in forming of structures of the flow in counter - current and co - current flow of the two-phase mixture.

On the basis of experimental examinations test stand they depend strictly on given streams of the liquid and the gas and they have significant influence on rising structures of the flow.

After analysing received images it is possible to state that the analysis of grey levels and the probability density function they are able to be serving tool for the specification of forming structures of the flow.

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INCREASING THE TECHNOLOGICAL RELIABILITY OF SHAFTS' WITH SMALL STIFFNESS MACHINING

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In the paper they show the method of increasing the machining reliability, that consists in elastic-deformable state creating – for this purpose they worked out the construction of tailstock with vibratory walking pneumatic drive with linear action. They show the computational scheme of the drive and formulas to different dependences computing: dependence of tensile force change to normal stresses by parts' different diameters, dependence of tensile force change to pneumatic chambers diameters change, scheme of the system of elastic-deformable state controlling basing on the microprocessor, schematic diagram of winding gear controlling system basing on walking pneumatic drive, results of mathematical and physical modeling, results of experimental research.

In references [1, 2] they work out the technology of parts (shafts) with small stiffness forming and they present complex of means of automation and control, which contains devices and systems to program-following and adaptation control, electrical schemes of particular nodes and tailstocks construction, the complex enables, among all, increasing the accuracy and capacity of shafts with small stiffness machining.

For the purpose of enlargement the possibilities of functional automated machines systems for parts with small stiffness in the elastic-deformable state machining and increasing the reliability of technological machining, they worked out the construction of tailstock with vibratory walking drive with linear action [3], which drawing is presented in Fig. 1. The construction consists of frame 1, which can rotate owing to directional element 3. At the arbor's 2 left side on the thrust bearings they placed a sleeve 4 which is able to turn, there is the sleeve 5 with clamping screw 6 in it. The sleeve 5 is placed on a spring. At the right end of the tailstock's frame 1 there is the drive's body consisting of left half 7 and right half 8. The sleeve 9 (operating element) is able to move flat-parallel perpendicularly to axis. At the