XX Fluid Mechanics Conference KKMP2012
Gliwice, 17-20 September 2012

INTRODUCTION TO THE TURBULENT FLOWS THEORY – AN AXIALLY-SYMMETRIC PEACEFUL FLOWS

Tomasz JANKOWSKI
Poznań, Poland.
tomasz.jankowski@aquanet.pl

Key words: peaceful flow, structure of vector fields of power and shoots

The subject of this article is the dynamic structure of vector fields of power and shoots of axially-symmetric, peaceful flow of Newtonian fluid, which is the result of the imposition of the new, unknown until now, the original structure of the transverse motion on the classic form structure of peaceful flow, classic described by the differential, Navier-Stokes (NS) equations. The theory of transverse motion is a novelty in fluid mechanics. This is an essence of this article and is the foundation of a new theory of dualism longitudinal-transverse motion of Newtonian fluids, which is a component of the theory of turbulent flows.

The article is a response to the current lack of theory of turbulent flow. Turbulent flows, despite of research carried in this range for one and of half century, still are an unsolved problem of cognitive. Even the most universal the NS equations, regarded as the basis for mathematical descriptions of fluid motion, proved to be insufficient for this purpose, mainly due to an insufficient number of the output data taken into account. The need for new theory in this regard is therefore obvious. Introduction to this theory contains the text of this article.

The introduction of new theory into fluid mechanics requires at the start a critical analysis of existing activities, in this case the critical analysis of the NS equations. Following the arrows phenomenologically set of vectors of forces and shoots in the mass of fluid in motion, it is easy to see, that the equations are not interested the existence of transverse forces. Shoe these forces are existing, what is exampled in turbulent motion, in which the transverse forces destroy the thin marker thread, in generally well-known experiment of Reynolds. It is possible, these forces can be large, many times larger than the longitudinal forces. The problem is, they are not phenomenologically measurable. Therefore they are often ignored. This approach caused pathology, named in textbook fashion as "paradoxes" of fluid mechanics.

This article proposes an alternative into the phenomenological approach of describing the transport of fluids. This is a microstructure approach, consisting in the analysis of flow in pipes and channels with a different walls roughness, depending of their shape, length, cross section, and other geometric parameters. A new approach does not mean rejection of the results of previous actions. Proposes the fullest its use. In the beginning, from its side, it is proposed the extension of existing data base by new information about the transverse motion.

Proposed in this article, the new duality theory of longitudinal - transverse motion of Newtonian fluids takes into the consideration the new formula of microstructure of transverse motion in relation to the line of directional shoots. It authenticates by the relevant, new mathematical-physical model. At the same time not resign of the well-known, classical, mathematical-physical model of laminar Poiseuille flow, which describe the microstructure of longitudinal movement and the internal unit forces of friction being in the contrary of this movement. The new theory imposes the new transverse motion structure of on the classically described structure of the longitudinal movement.

Article have not universal character. The theory presented in him is merely a prelude to a comprehensive whole, which will be presented in stages, in subsequent articles. This stage is a base. Refers to the best known by the man, the case of steady, axially- symmetric, peaceful flow, homogeneous Newtonian fluid through the straight axial pipe with circle section, in a homogeneous gravitational force field. Such considerations limit allows for a full comparative analysis of the new with it, what is already known, ie comparison the new model and the classical model of Poiseuille, which ignore of existence of transverse forces. Indeed, in the present case, the transverse forces are invisible to the eye of the observer. It turns out that despite this, according to a new theory, they can identify and calculate their value.

Carried out in the article the analysis shows, that laminar flows are not homogeneous in its structure. Therefore, isolated from them peaceful flows, limited values of Reynolds numbers $0 \leq Re \leq Re_{pr}$, where the threshold value of this number is $Re_{pr} = 1962$, if the value of $g = 9{,}81$ m/s^2 $g = 9{,}81$ m/s^2.

The new theory of transverse motion and the forces it caused, adds credibility to the classical theory. It shows that this transverse force, indefinite so far, provokes the press effect and internal friction between the lamina of fluid being in motion. Confirmation of the existence of transverse forces leads towards harmonization of the shifting (sliding) friction definitions, which are different nowadays between the liquid state physics and the solid state physics.

The subject-matter, the dynamic structure of the flow arises from the processing of external forces at internal forces, which cause the motion of whole mass of fluid and the motion of its individual particles. The shape of this structure is determined by the shape of its force (acceleration) vector fields and momentum (velocity) vector fields, each considered separately. In this case, the structure of the velocity vector field is well known. The shape of this is the rotative parabola, the typical shape for laminar flow. Until now it is noticed the description lack of the structure of the force field, which influence on the shape of the velocity field, described above. The intention of this article is to break this state of affairs.

Article proposed on the conference aspires to become one of these publications, which pave the way for new solutions in the field of the fundamental problems of fluid mechanics. The focus of it is the description of force field description and its influence on the shape of the velocity field in the fluid in motion. The shape and structure of this field are the keys to understanding the issues of fluid motion. Theoretically derived, based on two models of this field, the description of evolution the convex of phase space of the analyzed fluid mass as a function of the Reynolds number Re, regardless of its complexity, has been brought to the dual description of the motion of a single point in the direction defined by the vectors of the forces encountered arrows and shoots. The new theory does not interfere with the actual exist achievements of science in this area. It is their complement, which for example, it can be confirmed the formula of changes of the linear coefficient of peaceful flow in the calm; $\lambda = f(Re)$, where $\lambda = 64/Re$ in the field $0 \leq Re \leq 1962$.

Article is about 15 - 20 A4 pages and is illustrated with diagrams and drawings. That's a lot of pages, but only in this form can be presented a complete whole, the content of which is an introduction to the theory of turbulent flow. It is the first step in solving the problem so far unresolved. Forms the basis of a new perception of reality.