MODEL OF FLUID FLOW IN NANOTUBE: CLASSICAL AND QUANTUM FEATURES

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Different applications of nanostructures are related with fluid flows through these systems. In its turn, experiments show that flows in nanostructures have many specific features, which can't be explained in classical terms only. Particularly, flow through nanotube is extremely fast in comparison with its classical analog. We suggest a model based on the possibility of existence of molecular clusters (Frenkel crystallites) in the fluid [1]. There are some experimental evidences of such phenomenon. Under this assumption one needs to take into account quantum effects. Particularly, the boundary condition, which plays the crucial role for the flow in nanostructures, takes the form of sliding condition instead of the adhesion condition for the classical flow. The parameters of the boundary conditions are determined by solving of quantum scattering problem for the particle of the fluid and the wall potential. Main features of the flow are described in the framework of the model. For very narrow nanotubes another phenomena have an influence on the flow-possibility of existence of solitons in nanotube walls. These soliton solutions are similar to Davidov solitons in molecular chains. This model of flow is also described.

References

[1] S.A.Chivilikhin, V.V.Gusarov, I.Yu.Popov, A.I.Svitenkov *Model of fluid flow in a nano-channel*. Russian J. of Math. Phys., **15 (3)**, 410-412 (2008)