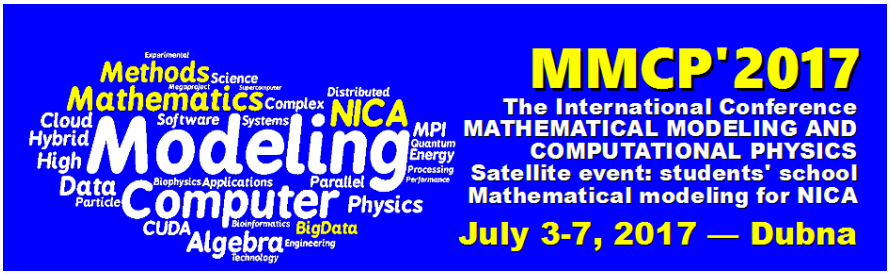

Contribution ID: **129** Type: **not specified**

Generalized Darcy's law in filtration theory

Thursday 6 July 2017 14:00 (15 minutes)

GENERALIZED DARCY'S LAW IN FILTRATION THEORY

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We study the hydrodynamics of flow in porous medium modeling the grain filling in filters. Using the lattice approximation, we derive the structure of the current in porous medium and obtain the transverse diffusion coefficient which proves to be proportional to the diameter d of the grain. We consider the axially-symmetric stationary flow with the velocity components in cylindrical coordinates The current density of the liquid takes the form

with the density of the liquid being unit. Solving the corresponding continuity equation and neglecting the radial velocity one can explain the so-called "near-wall"effect for the case of cylindrical filter, resulting in large value of velocity near the wall [1] of the filter tube.
To find the profiles of the velocity and the pressure p, it is necessary to solve also the Euler equation

where the force density includes the gravity acceleration and the Darcy's force In the simplest approximation the Darcy's coefficient appears to be constant: but in general it should be some function of the velocity and pressure. We suggest a generalization of the Darcy's law by including in the natural invariant in the simplest linear form: We analyze the dependence of the filtration process on the coefficient

References

[1] Yu.P. Rybakov, G.N. Shikin, Proceedings of the 16th International Conference "Mathematical Methods in Techniques and Technologies(MMTT-16, St-Petersburg)", 1(2003) 138-139.

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Session Classification: Physical processes modeling and related computational methods (III)