Koroleva Y. O., Korolev A.V. (Moscow, Russia) – **On a hydrodynamic problem in a domain with random roughness.**

We study three-dimensional incompressible flow of lubricant in a domain bounded by two moving surfaces $x_3 = \varepsilon h^{\pm}(x_1, x_2, t),\ (x_1, x_2) \in \omega, t \in [0, T]$ with a rough random structure. It is assumed that parameter $\varepsilon > 0$ characterizes the thickness of the gap between the surfaces. The roughness of the surfaces is assumed to be an ergodic stochastic process, thus pressure is also a stochastic process. We rigorously derive the stochastic Reynolds equation which describes pressure of the lubricant in the limit as $\varepsilon \to 0$:

$$D_t h + \operatorname{div}\left(-\frac{h^3}{12\nu}\nabla p^* + \frac{h}{2}(v^+ + v^-)\right) = 0 \quad \text{in } \omega \times (0, T) \tag{1}$$

Here ν is the viscosity of lubricant, $v^{\pm}$ are given velocities of the surfaces, $h \equiv h^+ - h^- = h_0 + h_s$, h_0 is a film thickness corresponding to smooth surfaces while term h_s describes the roughness of the surfaces and is assumed to be a randomly varying field of mean 0.

The obtained result generalizes an analysis of a similar lubrication problem in a domain with a smooth deterministic boundary, see [1],[2].

REFERENCES

1. *J. Fabricius, Y. Koroleva and P. Wall,* A rigorous derivation of the time-dependent Reynolds equation, Asympt. Anal., 2013, vol. 84, № 1–2, pp. 103–121.

2. *J. Fabricius, Y. Koroleva and P. Wall,* Asymptotic behavior of Stokes flow in a thin domain with a moving rough boundary, Proc. R. Soc. A, 2014, vol. 470, №2167, 20130735, 21 p.

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