Optimal design in non-Newtonian oscillating-cup viscometry

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Аннотация

We discuss an optimal experimental design in nonlinear oscillating-cup viscometry. The methods include analysis of model identifiability in terms of Jacobi matrix, creation of criterion for consistency of experimental and calculated data, search of components of covariance matrices of unknown parameters from measurable values, check of model adequacy and choice of optimal experiment conditions on the basis of sensitivity theory. We use the mathematical models of such viscometric experiment as in [1, 2] that include rheological constitutive equation, mass conservation equation and momentum conservation equation for fluid, equation of viscometer oscillations, initial and boundary conditions. Damped and forced modes are considered. We study optimal conditions to observe and identify nonlinear rheological constants, for examples, yield stress. Some problems of linear oscillating-cup viscometry are analysed, for examples, for different viscoelastic models. The computational model is implemented in Fortran. The work was partially supported by the Russian Foundation for Basic Research (N 13-08-00971).

References

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2. Elyukhina I. Oscillating-cup technique for yield stress and density measurement (2013) J Mater Sci 48:4387–4395.