

# Modeling Solid-Liquid Settling System as a Two-Phase Flow Problem

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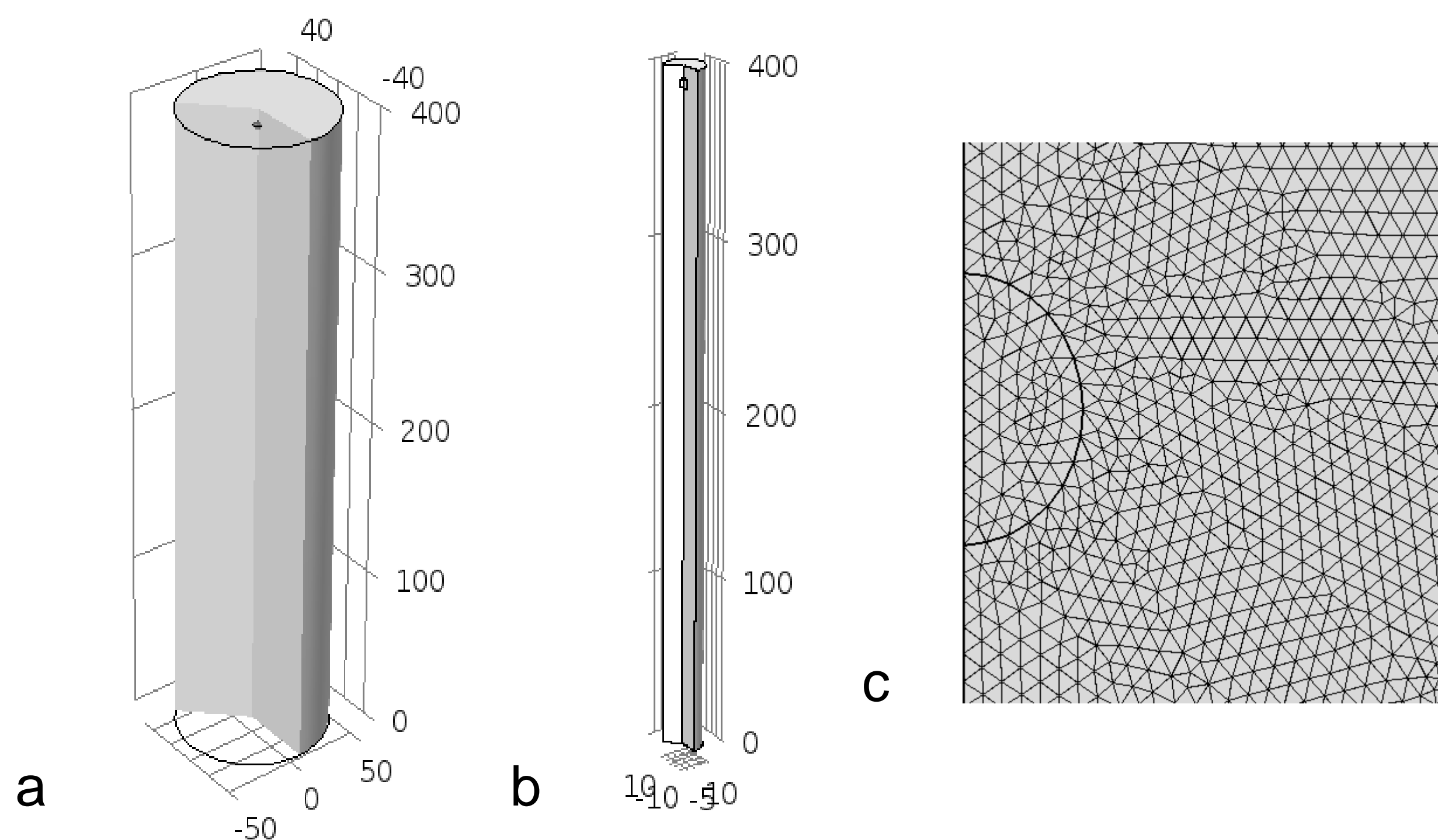
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## Abstract

Sedimentation is used in many industrial processes such as water purification and food industry. As a two-phase system, researchers face with challenges by modeling the settling process. A solid-fluid system is modelled and simulated in COMSOL Multiphysics® environment by CFD Module, Level Set method. However the method is originally for tracking interface between immiscible fluid-fluid or fluid-gas phases, model parameter investigations are done to explore the opportunities to use the model for solid-fluid systems.

## Model Set-up

In our investment 5.9 mm sphere shaped solid particles are dropped into a 100 mm diameter and 400 mm high column of liquid. The aim of the simulation is to predict the settling velocity of the particles. One measurement result is available for us which gave the terminal velocity of the nylon bead in water to 143 mm/s. Figure 1.a shows the experimental set-up, and Figure 1.b which was used for simulations.



**Figure 1.** The real geometry of the equipment with the bead [mm] a), the reduced geometry for calculations b), and the computational mesh c)

## Materials and Methods

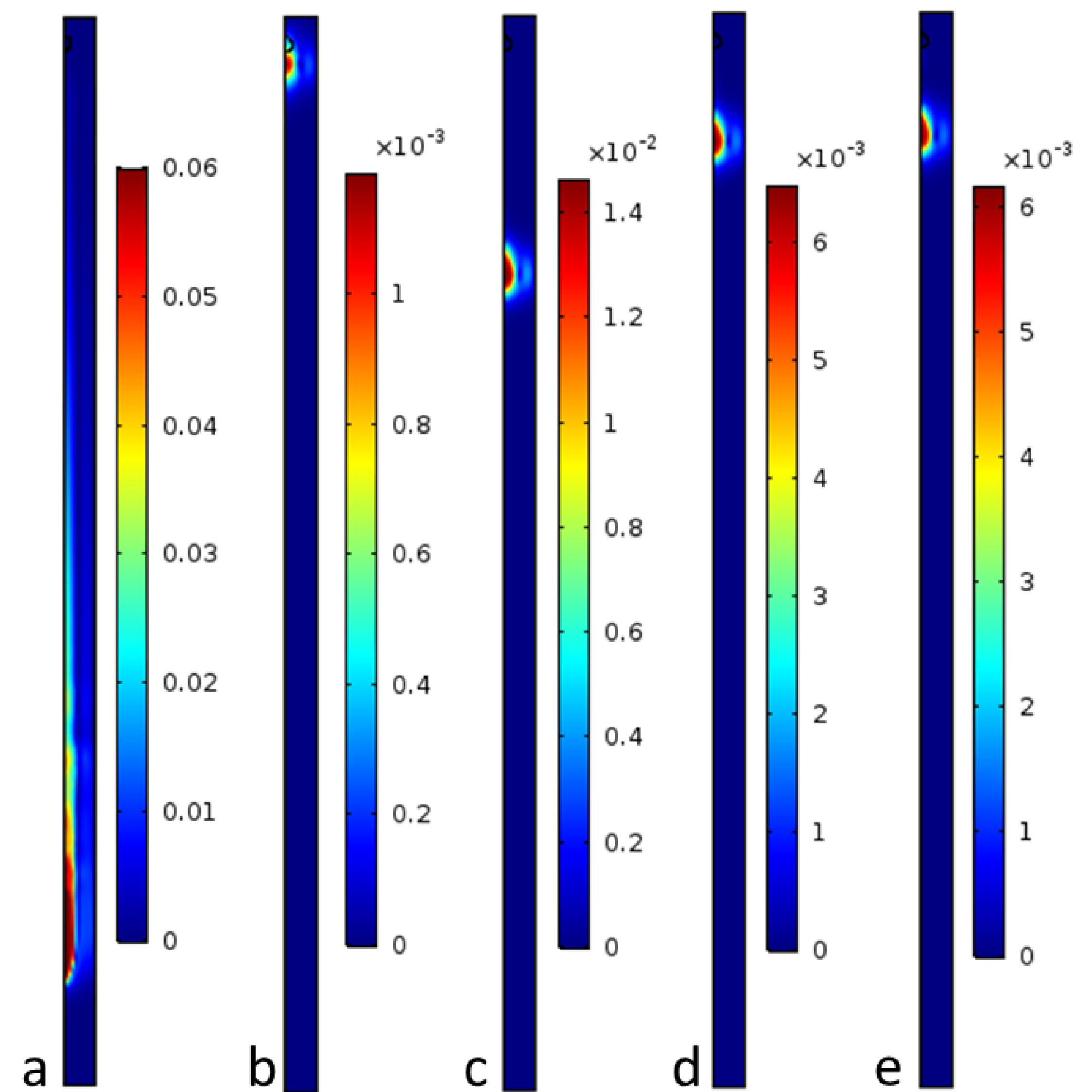
Table 1 contains all investigated materials by Level Set method. Nylon is quasi-fluid in this approach.

		Density (kg/m <sup>3</sup> )	Dynamic viscosity (Pas)
Fluid 1	nylon	1114	"10"
	water	1000	0.0009
Fluid 2	silicone oil	1000	0.6
	paraffin oil 1	827	0.11
	paraffin oil 2	890	0.23
	gear oil	850	0.32

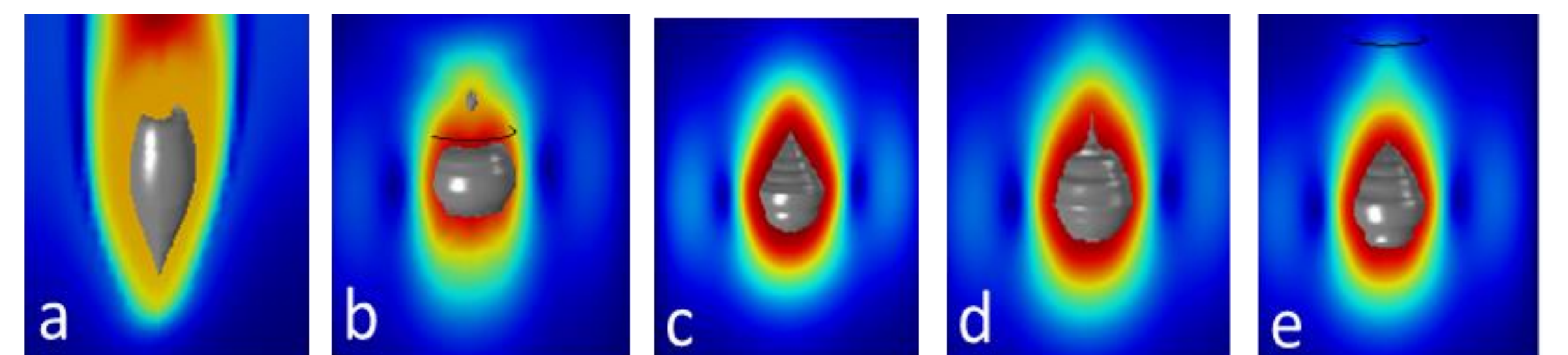
**Table 1.** Density and viscosity values of the materials

## Simulation Results and Discussion

Velocity fields (Figure 2) and deformation (Figure 3) in case of settling the nylon bead in different fluids. Level Set method was used to track the interface.



**Figure 2.** Velocity fields [m/s] in case of the different fluids. a) water, b) silicone oil, c) paraffin oil 1, d) paraffin oil 2, e) gear oil



**Figure 3.** Falling nylon bead in different fluids at t=2 s. Deformation can be observed as a consequence of treating solid bead as viscous fluid.

For the animation gained from the time dependent solution scan the QR code on the right. For more model examination results check out the conference paper.



## Acknowledgements

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