

Suspended Particles in Elastic Fluids: From Fracking Fluids to Swimming Worms

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Rigid or flexible particles suspended in viscoelastic fluids are ubiquitous in the food industry (e.g. pastes), industrial molding applications (all composites and 3-D printed parts), the energy industry (e.g. fracking fluids), and biological fluids (i.e. swimming of bacteria in mucous). The mathematical description of these suspensions is in its infancy. For example, the foundational work in Newtonian suspensions was accomplished by Einstein in 1905, but that same calculation in an elastic fluid appeared last year (!) However, the real breakthrough has been the development of a computational simulation of such viscoelastic suspensions, with particle level resolution. These simulations will allow the principles which govern the simplest flows of such suspensions, which are now not understood at all, to become elucidated in the next decade. I will describe three foundational problems that have now been analyzed using these new computational methods – including fracking fluid design and swimming in mucous.