Preface to Special Issue: Papers from HSR 2017—8th International Meeting of the Hellenic Society of Rheology, Limassol, Cyprus, July 12–14, 2017

Georgios C. Georgiou[1,a)] and Andreas N. Alexandrou[2,b)]
[1]*Department of Mathematics and Statistics, University of Cyprus, P.O. Box 20537, 1678 Nicosia, Cyprus*
[2]*Department of Mechanical and Manufacturing Engineering, University of Cyprus, P.O. Box 20537, 1678 Nicosia, Cyprus*

(Received 21 February 2018; accepted 21 February 2018; published online 19 March 2018)

https://doi.org/10.1063/1.5026596

The Hellenic Society of Rheology (HSR) was established in 1996 in Nicosia by Greek rheologists residing in Greece, Cyprus, and elsewhere. It is affiliated with the European Society of Rheology (ESR) and dedicated to the promotion of scientific activities and advancement in the fields of rheology and fluid mechanics. The first meeting of the HSR took place in 1996 in Nicosia, Cyprus. This was followed by meetings in Heraklion (1998 and 2014), Patras (2001), Athens (2004 and 2011), and Rhodes (2007). Although the size of HSR meetings might be small (40-60 delegates), they always attract eminent rheologists from all over the world in addition to the invited speakers. The scientific programme has no parallel sessions and, to that end, all the talks are plenary.

The 8th International Meeting of the Hellenic Society of Rheology (HSR 2017) was jointly co-organized by the HSR, the University of Cyprus, and the Cyprus University of Technology in the beautiful coastal city of Limassol, Cyprus. The meeting was attended by 60 delegates from Greece, Cyprus, and fourteen other countries (Bulgaria, Canada, France, Germany, Iran, Ireland, Israel, Jordan, Luxembourg, Portugal, Russia, Switzerland, the UK, and the USA), thus being truly international. The conference spanned different topics, such as rheology and rheometry, colloids and suspensions, structure and dynamics of polymers, molecular modeling, mathematical modeling and approximate methods, numerical simulations, blood flows, and viscoplasticity. The program included three invited keynote talks, 39 regular talks, and 13 poster presentations. The invited lectures were given by Professor Michel Cloitre of Paris Tech, France ("Bottlebrush polymers in colloidal suspensions and nanocomposites"), Professor Moshe Gottlieb of Ben Gurion University, Israel ("Interfacial rheology of block copolymers"), and Professor Fernando Pinho of Universidade do Porto, Portugal ("Turbulence models for non-Newtonian fluid flows"). The conference would not be possible without the gratefully acknowledged financial support of the University of Cyprus, the Cyprus University of Technology, the Cyprus Tourism Organization, and the Cyprus Department of Antiquities.

This Special Issue consists of representative papers presented at HSR 2017. Some of these studies fall within the category of applied rheology combining both experimental and modeling studies. These papers include Ebrahimi *et al.*[1] who studied the slip velocity of a high molecular weight high-density polyethylene (HDPE) in steady and dynamic shear experiments using a stress/strain controlled rotational rheometer. These authors applied the multimode integral Kaye-Bernstein-Kearsley-Zapas constitutive model to predict the transient shear response of the polymer melt obtained from a rotational rheometer to show that the slip velocity is largely affected by surface energy. Antonopoulou *et al.*[2] proposed a 1D model for sedimentation using an effective maximum volume fraction, with an extension for sedimentation under centrifugal force, and carried out experiments with silica suspensions using an analytical centrifuge showing that effective maximum volume fraction accurately captures interparticle interactions and provides insights into the effect of centrifugation on sedimentation. Kaliviotis *et al.*[3] employed constitutive equations that they proposed earlier to estimate local viscosity characteristics for blood flow in a T-type bifurcating microchannel. Their results demonstrate that the viscosity is low in the branches of lower flow rate, which helps explain why the effects of physiological red blood cell aggregation have no adverse effects in terms of *in vivo* vascular resistance.

Constitutive equation modeling has always been a popular topic in HSR meetings. Mwasame *et al.*[4] extended a macroscopic model for the dynamics and rheology of a dilute emulsion with droplet morphology that they developed recently using the bracket formulation of non-equilibrium thermodynamics (NET) to also account for particle inertia effects. One of the advantages of using NET to derive mascoscopic models for complex fluids is the guarantee that the models are consistent with the laws of thermodynamics, as extended to non-equilibrium systems. The generalized bracket formulation was also used by Tsimouri *et al.*[5] to derive a constitutive rheological model for human blood which accounts for the formation and dissociation of rouleaux. The expressions for the aggregation and dissociation rates are derived self-consistently through the formalism as a function of the applied flow strength and rouleau conformation, allowing therefore for the avoidance of need to resort to phenomenological approximations to specify these rates.

Viscoplasticity has also been a popular topic in HSR meetings. Muravleva[6] studied numerically the axisymmetric squeeze flow of a Bingham plastic with the slip yield boundary condition at the wall employing augmented Lagrangian

a)E-mail: georgios@ucy.ac.cy
b)E-mail: andalexa@ucy.ac.cy

methods to compute the shape of the yield surface, velocity, and stress fields. Panaseti *et al.*[7] modeled the lubrication flow of a Herschel-Bulkley fluid with pressure-dependent rheological parameters in a symmetric long channel of varying width extending the approach proposed by Fusi *et al.*[8] for a Bingham plastic, which avoids the so-called lubrication paradox. They showed, in particular, that in a channel of constant width, the width of the unyielded core is also constant and the pressure distribution is not affected by the yield-stress pressure dependence. Salmanidou *et al.*[9] modeled the sliding episodes that formed the Rockall Bank Slide Complex using different types of rheological models in order to compute the total retarding stress and simulate submarine failure and considered the Bingham rheology and the frictional rheology in modeling the flow behavior.

Syrakos *et al.*[10] simulated the flow of silicone oil in a fluid damper, modeled by the Phan-Thien and Tanner and Carreau-Yasuda constitutive equations, and showed that fluid elasticity can affect the damper behavior in significant ways, being responsible for the "stiffness" (i.e., spring-like behavior) that is observed in experimental studies in the form of hysteresis in the force diagrams.

Papers relating to the derivation of analytical solutions and to theoretical analyses were also well represented. Saengow and Giacomin[11] derived exact expressions for the nonlinear complex viscosity and the corresponding nonlinear complex normal stress coefficients, for the Oldroyd 8-constant framework for oscillatory shear sweeps in large-amplitude oscillatory shear flow (LAOS) experiments. Kalogirou[12] derived an asymptotic model in the thin-layer approximation for a two-fluid shear flow where the interface between the two fluids is coated with an insoluble surfactant, which includes important physical effects such as Marangoni forces, inertial forces arising in the thick fluid layer, as well as gravitational forces. Lytra and Pelekasis[13] investigated the static response of coated microbubbles using a novel approach in modeling contact between a microbubble and the cantilever of an atomic force microscope.

On behalf of the Organizing Committee, we would like to thank all the authors for contributing to this Special Issue. We also wish to thank Professor Jeffrey Giacomin for his energetic participation with a presentation and enlightening interventions during the discussion and the banquet and his encouragement and support in devoting a special issue of Physics of Fluids to HSR 2017.

[1]M. Ebrahimi, V. K. Konaganti, and S. G. Hatzikiriakos, "Dynamic slip of polydisperse linear polymers using partitioned plate," Phys. Fluids **30**, 030601 (2018).
[2]E. Antonopoulou, C. F. Rohmann-Shaw, T. C. Sykes, O. J. Cayre, T. N. Hunter, and P. K. Jimack, "Numerical and experimental analysis of the sedimentation of spherical colloidal suspensions under centrifugal force," Phys. Fluids **30**, 030702 (2018).
[3]E. Kaliviotis, J. M. Sherwood, and S. Balabani, "Local viscosity distribution in bifurcating microfluidic blood flows," Phys. Fluids **30**, 030706 (2018).
[4]M. M. Mwasame, N. J. Wagner, and A. N. Beris, "On the macroscopic modeling of dilute emulsions under flow in the presence of particle inertia," Phys. Fluids **30**, 030704 (2018).
[5]I. Ch. Tsimouri, P. S. Stephanou, and V. G. Mavratzas, "A constitutive rheological model for agglomerating blood derived from nonequilibrium thermodynamics," Phys. Fluids **30**, 030710 (2018).
[6]L. Muravleva, "Squeeze flow of Bingham plastic with stick-slip at the wall," Phys. Fluids **30**, 030709 (2018).
[7]P. Panaseti, Y. Damianou, G. C. Georgiou, and K. D. Housiadas, "Pressure-driven flow of a Herschel-Bulkley fluid with pressure-dependent rheological parameters," Phys. Fluids **30**, 030701 (2018).
[8]L. Fusi, A. Farina, F. Rosso, and S. Roscani, "Pressure-driven lubrication flow of a Bingham fluid in a channel: A novel approach," J. Non-Newtonian Fluid Mech. **221**, 66–75 (2015).
[9]D. M. Salmanidou, A. Georgiopoulou, S. Guillas, and F. Dias, "Rheological considerations for the modelling of submarine sliding at Rockall bank, NE Atlantic Ocean," Phys. Fluids **30**, 030705 (2018).
[10]A. Syrakos, Y. Dimakopoulos, and J. Tsamopoulos, "Theoretical study of the flow in a fluid damper containing high viscosity silicone oil: Effects of shear-thinning and viscoelasticity," Phys. Fluids **30**, 030708 (2018).
[11]C. Saengow and A. J. Giacomin, "Exact solutions for oscillatory shear sweep behaviors of complex fluids from the Oldroyd 8-constant framework," Phys. Fluids **30**, 030703 (2018).
[12]A. Kalogirou, "Instability of two-layer film flows due to the interacting effects of surfactants, inertia and gravity," Phys. Fluids **30**, 030707 (2018).
[13]A. Lytra and N. Pelekasis, "Static response of coated microbubbles compressed between rigid plates: Simulations and asymptotic analysis including elastic and adhesive forces," Phys. Fluids **30**, 030711 (2018).