

# Papers from the 2019 Institute of Non-Newtonian Fluid Mechanics Meeting in Lake Vyrnwy, Wales

Cite as: Phys. Fluids **32**, 040401 (2020); <https://doi.org/10.1063/5.0008256>

Submitted: 20 March 2020 . Accepted: 20 March 2020 . Published Online: 13 April 2020

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**Note:** This paper is part of the Special Topic on Papers from the Institute of Non-Newtonian Fluid Mechanics Meeting, Lake Vyrnwy, 2019.

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<https://doi.org/10.1063/5.0008256>

The Institute of Non-Newtonian Fluid Mechanics (INNFM) held its meeting during April 2019, once again in the idyllic setting of Lake Vyrnwy, Wales. Friends and colleagues working in the field of rheology of non-Newtonian fluids gathered to discuss and present their latest ideas and findings. The conference program was divided into several themed sessions including polymer dynamics, computational rheology, modeling, yield stress fluids, rheometry, and applied rheology. A British Society of Rheology session saw the Society's Annual Award presented to Professor Rob Poole, University of Liverpool, UK. The meeting also included a poignant session dedicated to the late Professor Mike Webster, Swansea University, UK. Mike was secretary of the INNFM and made many influential contributions to the field of computational rheology. There is no coincidence that several of the papers in this special topic involve aspects of numerical simulation of non-Newtonian fluids.

Sarmadi and Frigaard<sup>1</sup> developed an analytical method to examine inertial effects on lubrication forces in triple-layer core annular pipeline flow, which has applications in transportation of heavy oils. Sverdrup *et al.*<sup>2</sup> presented a methodology for simulating three-dimensional flow of incompressible viscoplastic fluids including creeping flow of Bingham plastics around translating objects. Evans *et al.*<sup>3</sup> presented numerical simulations of transient planar stick-slip flow of Phan-Thien–Tanner and Giesekus fluids, which are important for understanding industrial processes such as extrusion of molten polymers through a die. Kanso *et al.*<sup>4</sup> explored the emergence and evolution of order in a nematic polymeric liquid subject to large amplitude oscillatory shear flow and provided analytical benchmarks for numerical solutions to the diffusion equation for both oscillatory and steady shear flows. Iqbal *et al.*<sup>5</sup> performed an extensive characterization of the material

properties of a binder used in polymer bound explosives and developed a constitutive model, based on visco-hyperelasticity, suitable for implementation in commercially available finite element packages. Evans and Evans<sup>6</sup> determined the nature of the extrudate swell singularity for Phan-Thien–Tanner and Giesekus fluids, which has important applications in the extrusion of molten polymers. Oishi *et al.*<sup>7</sup> considered how rheology and surface tension influence the dynamics of capillary drops impacting solid surfaces. The insights into phenomena such as droplet spreading and contact time will have important applications in, for example, inkjet printing, fire suppression, and food processing. Chen *et al.*<sup>8</sup> evaluated a new model for predicting fiber reorientation speeds as a function of local flow kinematics which will prove useful in understanding fiber orientation in injection molded components. McIlroy<sup>9</sup> proposed a new fundamental rule concerning the influence of flow on crystallization dynamics that has practical applications in ensuring or eliminating the formation of flow-enhanced structures through control of processing conditions and/or material properties. Curtis and Davies<sup>10</sup> demonstrated how to interpret response spectra obtained through parallel and orthogonal superposition rheometry in the case of Wagner I and Kaye-Bernstein, Kearsley, Zapas (K-BKZ) fluids. Special bases that enable interconversion between parallel and orthogonal response spectra were introduced that facilitated direct model-based comparison of parallel and orthogonal superposition moduli in the study of weak non-linear response.

On behalf of the INNFM, we wish to take this opportunity to thank each of the authors for their contribution to this special topic. We would like to express our particular thanks to Professor Jeffrey (Jeff) Giacomin for his continued support and the invitation to host this special topic in *Physics of Fluids*. The meeting

will also be remembered for Jeff's highly entertaining after dinner speech which was capped off by his rather unexpected rendition of Joni Mitchell's "Both Sides Now." The INNFM meeting returns in 2021, to be held at the enchanting Italianate village of Portmeirion, North Wales.

## REFERENCES

- <sup>1</sup>P. Sarmadi and I. A. Frigaard, "Inertial effects in triple-layer core-annular pipeline flow," *Phys. Fluids* **31**, 103102 (2019).
- <sup>2</sup>K. Sverdrup, A. Almgren, and N. Nikiforakis, "An embedded boundary approach for efficient simulations of viscoplastic fluids in three dimensions," *Phys. Fluids* **31**, 093102 (2019).
- <sup>3</sup>J. D. Evans, J. A. Cuminato, I. L. Palhares Junior, and C. M. Oishi, "Numerical study of the stress singularity in stick-slip flow of the Phan-Thien Tanner and Giesekus fluids," *Phys. Fluids* **31**, 093101 (2019).
- <sup>4</sup>M. A. Kanso, L. Jbara, A. J. Giacomin, C. Saengow, and P. H. Gilbert, "Order in polymeric liquids under oscillatory shear flow," *Phys. Fluids* **31**, 033103 (2019).
- <sup>5</sup>M. Iqbal, J. Y. S. Li-Mayer, D. Lewis, S. Connors, and M. N. Charalambides, "Mechanical characterization of the nitrocellulose-based visco-hyperelastic binder in polymer bonded explosives," *Phys. Fluids* **32**, 023103 (2020).
- <sup>6</sup>J. D. Evans and M. L. Evans, "The extrudate swell singularity of Phan-Thien-Tanner and Giesekus fluids," *Phys. Fluids* **31**, 113102 (2019).
- <sup>7</sup>C. M. Oishi, R. L. Thompson, and F. P. Martins, "Impact of capillary drops of complex fluids on a solid surface," *Phys. Fluids* **31**, 123109 (2019).
- <sup>8</sup>H. Chen, P. Wapperom, and D. G. Baird, "The use of flow type dependent strain reduction factor to improve fiber orientation predictions for an injection molded center-gated disk," *Phys. Fluids* **31**, 123105 (2019).
- <sup>9</sup>C. McIlroy, "A fundamental rule: Determining the importance of flow prior to polymer crystallization," *Phys. Fluids* **31**, 113103 (2019).
- <sup>10</sup>D. J. Curtis and A. R. Davies, "On response spectra and Kramers-Kronig relations in superposition rheometry," *Phys. Fluids* **31**, 127105 (2019).