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Preface to Special Visual Issue: E Mitsoulis

This special issue honors Professor Evan Mitsoulis for his significant contributions to rheology and computational non-Newtonian fluid mechanics. Mitsoulis's career has left a lasting impact through his innovative research, mentorship, and dedication, as detailed in Professor Hatzikiriakos's article[1]. Starting at McMaster University with his Ph. D., he taught at the University of Ottawa and the National Technical University of Athens (NTUA) until his retirement.

Professor Mitsoulis made notable advances in several areas:

- Modeling polymer melts and solving flow and transport problems for viscoelastic fluids, which have improved extrusion processes.
- Using the K-BKZ model to study complex viscoelastic flows.
- Conducting comprehensive research in capillary rheometry on various systems, addressing issues like viscous heating and wall slip.
- Developing finite element algorithms for accurate modeling of complex material flows.
- Creating numerical packages for polymer processing operations such as extrusion and injection molding, significantly impacting industry.
- Investigating viscoplasticity, including wall slip phenomena.

In addition to his technical achievements, Mitsoulis has mentored many graduate students and postdoctoral fellows, fostering their careers. His active participation in professional societies like the Hellenic Society of Rheology and the Polymer Processing Society has also benefited the scientific community.

This special issue brings together a collection of papers that reflect the wide-ranging impact of Professor Mitsoulis' work. It is a testament to his enduring legacy and a celebration of his numerous contributions to the fields of rheology and computational non-Newtonian fluid mechanics.

Tanner[3] investigates the yielding behavior of lubricating greases, finding the von Mises yield criterion inadequate and highlighting the Tresca criterion's relevance, underscoring complexities in predicting soft materials' yielding. Stephanou[2] provides an analytical solution to the Johnson-Segalman/Gordon-Schowalter model, addressing oscillatory behavior in transient shear viscosity during start-up shear flow. The solution improves understanding of concentrated polymer solutions, identifying oscillations due to complex eigenvalues, and aligns with experimental observations. Georgiou and Huilgol[4] explore the Cheeger constant for various geometries to determine the minimum pressure gradient for steady flow in viscoplastic fluids, offering new methods for calculating it in convex polygons and ellipses, aiding flow dynamics understanding. Lambride et al.[5] study numerically the flow development of power-law fluids in pipe and channel flows using alternative definitions of the entrance length, e.g., the wall shear stress entrance length.

Danesh et al.[6] study the rheological properties of kaolinite/-surfactant/air bubble suspensions, finding yield stress increases with air volume and surfactant concentration, contributing to multiphase systems' rheological understanding. Ferrari and Franco[7] numerically investigate Bingham fluid flow in a lid-driven cavity, identifying the transition from stationary to periodic regimes at high Reynolds numbers, providing benchmarks for computational methods in viscoplastic fluid simulations. Lavrenteva et al.[8] simulate sedimentation of viscoplastic double emulsion drops using a boundary integral approach, focusing on interface deformation and unyielded zones, enhancing understanding of such systems under gravity-induced flow. Vereroudakis et al.[9] examine the shear startup response of a supramolecular polymer, showing rate-independent recovery times due to stress relaxation mechanisms, suggesting repeated shear-startup tests as indicators for evaluating stress relaxation models.

Aherwar et al.[10] numerically study laminar free convection from a vertical plate to power-law and Bingham fluids, finding shear-thinning fluids enhance heat transfer while Bingham yield stress reduces it, offering consolidated Nusselt number values. Izadi et al.[11] address the squeeze cementing process involving viscoplastic fluid in oil and gas well repair. Using an augmented Lagrangian approach, the study analyzes flow penetration characteristics, contributing to the reliability understanding of squeeze cementing. Housiadas and Georgiou[12] provide exact analytical solutions for Papanastasiou fluid flow in ducts with varying geometries, elucidating pressure drop and flow field effects. Psevdos et al.[13] present a monophasic model for blood flow in microvascular networks with a wall-slip condition, improving computational efficiency while maintaining accuracy, closely matching biphasic models and experimental data. Roberts and Cox[14] carry out numerical simulations of pressure-driven flow of a Bingham fluid through a serpentine two-dimensional channel in order to determine the size of location of stationary and moving unyielded regions and discuss the implications of blood displacement in varicose vein sclerotherapy.

On behalf of the Hellenic Society of Rheology, we would like to thank all the authors for contributing to this Special Issue. We are also grateful to the Editors of JNNFM, Professor Ian Frigaard, and Robert Poole for their encouragement and support in devoting a special issue to Professor Evan Mitsoulis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Yannis E. Dimakopoulos[a,*], Georgios C. Georgiou[b]
[a] *Department of Chemical Engineering, University of Patras, 26504 GR, Greece*
[b] *Department of Mathematics and Statistics, University of Cyprus, PO Box 20537, 1678 Nicosia, Cyprus*

[*] Corresponding author.
E-mail address: dimako@chemeng.upatras.gr (Y.E. Dimakopoulos).