



Introduction of the Special Issue Dedicated to Professor Jean-Marc Vanden-Broeck on the Occasion of his 70th Birthday

Paul Milewski¹ · Demetrios Papageorgiou² · Emilian Părău³ · Olga Trichtchenko⁴ · Zhan Wang⁵

Published online: 29 February 2024

© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2024

In May 2023, the meeting “Waves and Free Surface Flows: the next 20 years” was held at the International Centre for Mathematical Sciences (ICMS) in Edinburgh in honour of the 70th birthday of Professor Jean-Marc Vanden-Broeck. The meeting was delayed by 2 years due to the pandemic, and about 50 academics celebrated his career and achievements. For many, this was the first post-pandemic meeting, and this carried extra significance.

Jean-Marc was born in Liège September 11, 1951, and completed degrees at the University of Liège in Engineering Physics (1974) and Oceanography (1975). He moved to Australia for his PhD, completing it in Adelaide in 1978, advised by E. O. Tuck and L. W. Schwartz. His first works were on computations of free surface flows interacting with solid objects at low Froude number.

Following his PhD, he moved to the Courant Institute at New York University to work with Joe Keller and then moved to Stanford (following Keller) in 1979. In 1981, he became Assistant Professor at the University of Wisconsin, Madison, where in 1987 he became Full Professor. At Madison he met his wife, Mirna Džamonja, a logician. He stayed in Madison until 1998 when he moved to the University of East Anglia in the UK. Since 2007, he has been Professor of Mathematics at University College London. Throughout his career so far, he has had 17 completed PhD students and mentored several post-docs.

✉ Emilian Părău
E.Parau@uea.ac.uk

¹ Department of Mathematics, Eberly College of Science, Penn State University, State College, PA 16802, USA

² Department of Mathematics, Faculty of Natural Sciences, Imperial College, London SW7 2AZ, UK

³ School of Mathematics, University of East Anglia, Norwich NR4 7TJ, UK

⁴ Department of Physics and Astronomy, The University of Western Ontario, London N6G2V4, Canada

⁵ Institute of Mechanics, Chinese Academy of Sciences, Beijing 100190, People’s Republic of China

Jean-March has held many visiting positions and has made many long-term visits across the world, notably to the New Jersey Institute of Technology, the École Normale Supérieure de Cachan, Tel-Aviv University, the Technion in Haifa and Baruch College in New York.

Jean-Marc has produced seminal work over the past 40 plus years. He has written over 250 papers with over 50 in each of *Journal of Fluid Mechanics* and *Physics of Fluids*, the two widely recognised top journals in the field. His work has been used extensively both in applications and to inform results and directions in rigorous analysis. He has been influential in the development of many of his long-time co-authors, notably Demetrios Papageorgiou, Frederic Dias, Emilian Părău, Zhan Wang, Olga Trichtchenko and Paul Milewski.

A hallmark of his work is the inventive approach to free boundary problems combined with ingenious numerical methods, often using complex analysis and conformal mappings. Over the years Prof. Vanden-Broeck has discovered and computed several new types of waves, such as two-dimensional gravity–capillary solitary waves with damped oscillations [1, 2], generalised solitary waves with non-decaying oscillations [3], three-dimensional localised gravity–capillary solitary waves [4] and non-symmetric waves [5]. He has made huge progress in the famous Stokes waves problem by computing very accurately steep waves with sharp crests of 120° angle [6]. He has made pioneering studies of the waves with vorticity [7], sparking a considerable interest in this field. In recent years, Prof. Vanden-Broeck has obtained new results on free surface flows under electric fields [8], which have many potential applications in industry and in hydroelastic waves with applications to ice sheets [9, 10]. His earlier contributions in bubbles and jets [11, 12] and on viscous Hele–Shaw cells [13] have also inspired many researchers working on free surface flows. He is the author of the reference work on capillary gravity waves [14].

Jean-Marc has always been a great friend with his collaborators, contributing with his good humour and “joie de vivre”. This volume is a tribute to Jean-Marc and consists of some of the work presented at the 2023 meeting.

References

1. Hunter, J.K., Vanden-Broeck, J.-M.: Solitary and periodic gravity-capillary waves of finite amplitude. *J. Fluid Mech.* **134**, 205–219 (1983)
2. Vanden-Broeck, J.-M., Dias, F.: Gravity-capillary solitary waves in water of infinite depth and related free-surface flows. *J. Fluid Mech.* **240**, 549–557 (1992)
3. Vanden-Broeck, J.-M.: Elevation solitary waves with surface tension. *Phys. Fluids A Fluid Dyn.* **3**(11), 2659–2663 (1991)
4. Părău, E.I., Vanden-Broeck, J.-M., Cooker, M.J.: Nonlinear three-dimensional gravity-capillary solitary waves. *J. Fluid Mech.* **536**, 99–105 (2005)
5. Wang, Z., Vanden-Broeck, J.-M., Milewski, P.A.: Asymmetric gravity-capillary solitary waves on deep water. *J. Fluid Mech.* **759**, R2 (2014)
6. Vanden-Broeck, J.-M.: Steep gravity waves: Havelock’s method revisited. *Phys. Fluids* **29**(9), 3084–3085 (1986)
7. Vanden-Broeck, J.-M.: New families of steep solitary waves in water of finite depth with constant vorticity. *Eur. J. Mech. B Fluids* **14**(6), 761–774 (1995)
8. Papageorgiou, D.T., Petropoulos, P.G., Vanden-Broeck, J.-M.: Gravity capillary waves in fluid layers under normal electric fields. *Phys. Rev. E* **72**(5), 051601 (2005)

9. Milewski, P.A., Vanden-Broeck, J.-M., Wang, Z.: Hydroelastic solitary waves in deep water. *J. Fluid Mech.* **679**, 628–640 (2011)
10. Trichtchenko, O., Părău, E.I., Vanden-Broeck, J.-M., Milewski, P.A.: Solitary flexural-gravity waves in three dimensions. *Philos. Trans. R. Soc. A Math. Phys. Eng. Sci.* **376**(2129), 20170345 (2018)
11. Miksis, M., Vanden-Broeck, J.-M., Keller, J.B.: Axisymmetric bubble or drop in a uniform flow. *J. Fluid Mech.* **108**, 89–100 (1981)
12. Vanden-Broeck, J.-M., Keller, J.B.: Jets rising and falling under gravity. *J. Fluid Mech.* **124**, 335–345 (1982)
13. Vanden-Broeck, J.-M.: Fingers in a hele-shaw cell with surface tension. *Phys. Fluids* **26**, 2033–2034 (1983)
14. Vanden-Broeck, J.-M.: *Gravity-capillary Free-surface Flows*. Cambridge University Press, Cambridge (2010)

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.