

# Chapter 1

## oomph-lib related Publications

Here is a list of publications resulting from (or produced with) `oomph-lib`. If you have produced any work with `oomph-lib` and would like it to be listed here, send us a URL (or an electronic version of the publication) and we will install a link to it.

- Matharu, P., Hazel, A., & Heil, M. (2021). Spatio-temporal symmetry breaking in the flow past an oscillating cylinder. *Journal of Fluid Mechanics*, **918**, A42. doi:[10.1017/jfm.2021.358](https://doi.org/10.1017/jfm.2021.358).  
See also the accompanying "Focus on Fluids" article: Hourigan, K. (2021). Exotic wakes of an oscillating circular cylinder: How singles pair up. *Journal of Fluid Mechanics*, **922**, F1. doi:[10.1017/jfm.2021.492](https://doi.org/10.1017/jfm.2021.492)
- Nogueira Fontana, J.V., Juel, A., Bergemann, N., Heil, M. & Hazel, A. (2021) Modelling finger propagation in elasto-rigid channels. *Journal of Fluid Mechanics* **916** A27. doi:[10.1017/jfm.2021.219](https://doi.org/10.1017/jfm.2021.219)
- Xu, D., Heil, M., Seeboeck, T. & Avila, M. (2020) Resonances in Pulsatile Channel Flow with an Elastic Wall *Phys. Rev. Lett.* **125**, 254501. DOI: [10.1103/PhysRevLett.125.254501](https://doi.org/10.1103/PhysRevLett.125.254501)
- Vaquero-Stainer, C., Heil, M., Juel, A. & Pihler-Puzovic, D. (2019) Self-similar and disordered front propagation in a radial Hele-Shaw channel with time-varying cell depth. *Physical Review Fluids* **4**, 064002. DOI: [10.1103/PhysRevFluids.4.064002](https://doi.org/10.1103/PhysRevFluids.4.064002).
- Shepherd, D., Miles, J., Heil, M. & Mihajlovic, M. (2019) An adaptive step implicit midpoint rule for the time integration of Newton's linearisations of non-linear problems with applications in micromagnetics. *Journal of Scientific Computing* **80**, 1058-1082. DOI: [10.1007/s10915-019-00965-8](https://doi.org/10.1007/s10915-019-00965-8)
- Nielsen, A.R., Heil, M., Andersen, M. & Brons, M. (2019) Bifurcation theory for vortices with application to boundary layer eruption. *Journal of Fluid Mechanics* **865**, 831-849. DOI: <https://doi.org/10.1017/jfm.2019.97>
- Pihler-Puzovic, D., Peng, G., Lister, J. R., Heil, M. & Juel, A. (2018) Viscous fingering in a radial elastic-walled Hele-Shaw cell. *Journal of Fluid Mechanics* **849**, 163-191. DOI: <https://doi.org/10.1017/jfm.2018.404>
- Bergemann, N., Juel, A. & Heil, M. (2018) Viscous drop spreading on a layer of the same fluid: from sinking, wedging and spreading to their long-time evolution. *Journal of Fluid Mechanics* **843**, 1-28. DOI: <https://doi.org/10.1017/jfm.2018.127>.
- Walters, M.C., Heil, M., Whittaker, R.J. (2017) The Effect of Wall Inertia on High-Frequency Instabilities of Flow Through an Elastic-Walled Tube *The Quarterly Journal of Mechanics and Applied Mathematics*, hbx024. Direct electronic access to article. DOI: <https://doi.org/10.1093/qjmam/hbx024>

- Cisonni, J., Lucey, A.D., Elliott, S.J & Heil, M. (2017) The stability of a flexible cantilever in viscous channel flow *Journal of Sound and Vibration* **369** 186-202. DOI: [10.1016/j.jsv.2017.02.045](https://doi.org/10.1016/j.jsv.2017.02.045)
- Heil, M., Rosso, J., Hazel, A.L., Brons, M. (2017). Topological fluid mechanics of the formation of the Karman-vortex street. *Journal of Fluid Mechanics* **812** 199-221. DOI: <https://doi.org/10.1017/jfm.2016.792> (Open Access).
- Bertram, C. & Heil, M. (2017). A Poroelastic Fluid/Structure-Interaction Model of Cerebrospinal Fluid Dynamics in the Cord with Syringomyelia and Adjacent Subarachnoid-Space Stenosis. *Journal of Biomechanical Engineering*, **139**(1), 1-10. DOI: [10.1115/1.4034657](https://doi.org/10.1115/1.4034657)
- Heil, M. & Bertram, C. (2016). A poroelastic fluid-structure interaction model of syringomyelia. *Journal of Fluid Mechanics*, **809**, 360-389. DOI: <https://doi.org/10.1017/jfm.2016.669>
- Pestana, J., Muddle, R., Heil, M., Tisseur, F. & Mihajlovic M. (2016) Efficient block preconditioning for a C1 finite element discretisation of the Dirichlet biharmonic problem. *SIAM Journal on Scientific Computing* **38**(1), A325-A345. DOI: [10.1137/15M1014887](https://doi.org/10.1137/15M1014887) . (pdf)
- Heil, M. & Hazel, A.L. (2015) Flow in flexible/collapsible tubes. In: *Fluid-Structure Interactions in Low-Reynolds-Number Flows*. Eds: Duprat, C. & Stone, H.A. Royal Society of Chemistry, RSC Publishing.
- Pihler-Puzovic, D., Juel, A., Peng, G., Lister, J. & Heil, M. (2015) Displacement flows under elastic membranes. Part 1: Experiments and direct numerical simulations. *Journal of Fluid Mechanics* **784** 487- 511. DOI: [doi:10.1017/jfm.2015.590](https://doi.org/10.1017/jfm.2015.590) . (pdf)
- Peng, G., Pihler-Puzovic, D., Juel, A., Heil, M. & Lister, J. (2015) Displacement flows under elastic membranes. Part 2: Analysis of interfacial effects. *Journal of Fluid Mechanics* **784** 512- 547. DOI: [doi:10.1017/jfm.2015.589](https://doi.org/10.1017/jfm.2015.589) . (pdf)
- Cimpeanu, R., Martinsson, A. & Heil, M. (2015) A parameter-free perfectly matched layer formulation for the finite-element-based solution of the Helmholtz equation. *Journal of Computational Physics* **296** 329–347. DOI: [doi:10.1016/j.jcp.2015.05.006](https://doi.org/10.1016/j.jcp.2015.05.006).
- Pihler-Puzovic, D., Perillat, R., Russell, M., Juel, A. & Heil, M. (2013) Modelling the suppression of viscous fingering in elastic-walled Hele-Shaw cells. *Journal of Fluid Mechanics* **731**, 162-183 DOI: [10.1017/jfm.2013.375](https://doi.org/10.1017/jfm.2013.375)
- Pihler-Puzovic, D., Juel, A. & Heil, M. (2014) The interaction between viscous fingering and wrinkling in elastic-walled Hele-Shaw cells. *Physics of Fluids* **26**, 022102. DOI: [doi:10.1063/1.4864188](https://doi.org/10.1063/1.4864188).
- Shepherd, D., Miles, J., Heil, M., Mihajlovic, M. (2014) Discretisation induced stiffness in micromagnetic simulations. *IEEE Trans. Magn.*, **50**(11) 7201304. DOI: [10.1109/TMAG.2014.2325494](https://doi.org/10.1109/TMAG.2014.2325494)
- Muddle, R.L., Mihajlovic, M. & Heil, M. (2012) An efficient preconditioner for monolithically-coupled large-displacement fluid-structure interaction problems with pseudo-solid mesh updates. *Journal of Computational Physics* **231**, 7315-7334. DOI: [10.1016/j.jcp.2012.07.001](https://doi.org/10.1016/j.jcp.2012.07.001)
- Heil, M., Kharrat, T., Cotterill, P.A. & Abrahams, I.D. (2012) Quasi-resonances in sound-insulating coatings. *Journal of Sound and Vibration* **331** 4774-4784. DOI: [10.1016/j.jsv.2012.05.029](https://doi.org/10.1016/j.jsv.2012.05.029)
- Hazel, A. L., Heil, M., Waters, S.L. & Oliver, J.M. (2012) On the liquid lining in fluid-conveying curved tubes. *Journal of Fluid Mechanics* **705**, 213-233. DOI: [10.1017/jfm.2011.346](https://doi.org/10.1017/jfm.2011.346)
- Willoughby, N., Parnell, W. J., Hazel, A. L. & Abrahams, I. D.(2012) Homogenization methods to approximate the effective response of random fibre-reinforced composites *International Journal of Solids and Structures* **49**, 1421–1433. DOI: [10.1016/j.ijsolstr.2012.02.010](https://doi.org/10.1016/j.ijsolstr.2012.02.010)
- Hewitt, R. E., Hazel, A. L., Clarke, R. J. & Denier, J. P. (2011) Unsteady flow in a torus after a sudden change in rotation rate *Journal of Fluid Mechanics* , **68**, 88–119. DOI: [10.1017/jfm.2011.36](https://doi.org/10.1017/jfm.2011.36)
- Haines, P.E. Hewitt, R. E. & Hazel, A. L. (2011) The Jeffery–Hamel similarity solution and its relation to flow in a diverging channel *Journal of Fluid Mechanics* , **687**, 404–430. DOI: [10.1017/jfm.2011.362](https://doi.org/10.1017/jfm.2011.362)
- Bearon, R. N., Hazel, A. L. & Thorn, G. J. (2011) The spatial distribution of gyrotactic swimming micro-organisms in laminar flow fields. *Journal of Fluid Mechanics* , **680**, 602–635. DOI: [10.1017/jfm.2011.198](https://doi.org/10.1017/jfm.2011.198)

- Stewart, P.S., Heil, M., Waters, S.L. & Jensen, O.E. (2010) Sloshing and slamming oscillations in collapsible channel flow. *Journal of Fluid Mechanics* **662**, 288-319. ([abstract](#)) ([pdf](#)) ([Supplementary material \(movie\)](#))
- Whittaker, R.J., Heil, M., Jensen, O.E., & Waters, S.L. (2010) The onset of high-frequency self-excited oscillations in elastic-walled tubes. *Proceedings of the Royal Society A* **466**, 3635-3657. ([abstract](#)) ([pdf](#))
- Whittaker, R.J., Heil, M., Jensen, O.E., & Waters, S.L. (2010) A rational derivation of a tube law from shell theory. *Quarterly Journal of Mechanics and Applied Mathematics* ([pdf](#)) ([abstract](#))
- Heil, M., Boyle, J. (2010) Self-excited oscillations in three-dimensional collapsible tubes: Simulating their onset and large-amplitude oscillations. *Journal of Fluid Mechanics* **652**, 405-426 ([abstract](#)) ([pdf](#))
- Whittaker, R.J., Waters, S.L., Jensen, O.E., Boyle, J. & Heil, M. (2010) The energetics of flow through a rapidly oscillating tube. Part I: General theory. *Journal of Fluid Mechanics* **648**, 83-121 ([abstract](#)) ([pdf](#))
- Whittaker, R.J., Heil, M., Boyle, J., Jensen, O.E., & Waters, S.L. (2010) The energetics of flow through a rapidly oscillating tube. Part II: Application to an elliptical tube. *Journal of Fluid Mechanics* **648**, 123-153 ([abstract](#)) ([pdf](#))
- de Lózar, A., Juel, A. & Hazel, A. L. (2008) The steady propagation of an air finger into a rectangular tube. *Journal of Fluid Mechanics* **614**, pp 173–195. ([Link to electronic journal](#))
- Hazel, A.L. & Heil, M. (2008) The influence of gravity on the steady propagation of a semi-infinite bubble into a flexible channel. *Physics of Fluids* **20**, 092109. ([abstract](#)) ([pdf preprint](#))
- Heil, M., Hazel, A.L. & Boyle, J. (2008): Solvers for large-displacement fluid-structure interaction problems: Segregated vs. monolithic approaches. *Computational Mechanics*. ([journal link](#))
- Heil, M. & Waters, S.L. (2008) How rapidly oscillating collapsible tubes extract energy from a mean flow. *Journal of Fluid Mechanics* **601**, 199-227. ([journal link](#)).
- Hewitt, R. E. & Hazel, A. L. (2006) Midplane-symmetry breaking in the flow between two counter-rotating disks. *Journal of Engineering Mathematics*  
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- Heil, M. & Hazel, A. L. (2006) `oomph-lib` – An Object-Oriented Multi-Physics Finite-Element Library. In: *Fluid-Structure Interaction*, Editors: M. Schafer und H.-J. Bungartz. Springer (Lecture Notes on Computational Science and Engineering), pp 19–49. ([abstract](#)) ([pdf preprint](#))
- Heil, M. & Waters, S.L. (2006) Transverse flows in rapidly oscillating, elastic cylindrical shells. *Journal of Fluid Mechanics* **547**, 185-214. ([abstract](#)) ([pdf preprint](#))
- Jensen, O.E. & Heil, M. (2003) High-frequency self-excited oscillations in a collapsible-channel flow. *Journal of Fluid Mechanics* **481** 235-268. ([pdf preprint](#)) ([abstract](#))

The computations shown in this paper were performed in the days before `oomph-lib`, but the problem considered in this study now features in `oomph-lib` demo problems:

- [Flow in a 2D channel with an oscillating wall.](#)
- [Flow in a 2D collapsible channel.](#)

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## 1.1 PDF file

A [pdf version](#) of this document is available.