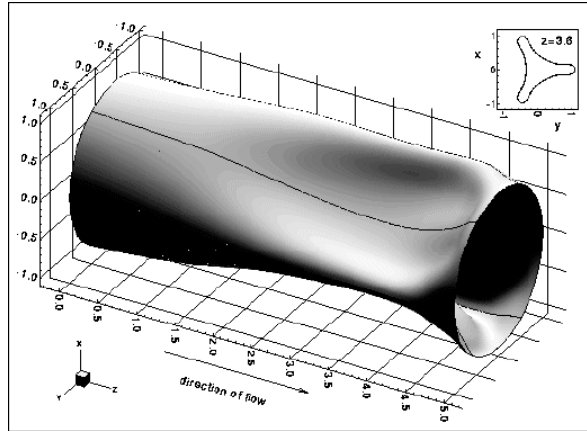


Professor Matthias Heil



From: Heil, M. & Jensen, O.E. (2003) Flows in deformable tubes and channels -- Theoretical models and biological applications. Chapter 2 of: Flow in Collapsible Tubes and Past Other Highly Compliant Boundaries. Eds: T.J. Pedley and P.W. Carpenter. pp. 15-50. Kluwer, Dordrecht, Netherlands.

See:

<http://www.ma.man.ac.uk/~mheil/>

<http://www.maths.manchester.ac.uk/people/staff/profile/?ea=matthias.heil>

<http://www.maths.manchester.ac.uk/people/staffspotlights/matthias-heil/>

<http://www.manchester.ac.uk/research/Matthias.heil/publications>

<http://www.manchester.ac.uk/research/Matthias.heil/research>

<https://scholar.google.com/citations?user=9VrEczwAAAAJ&hl=en>

School of Applied Mathematics
University of Manchester, UK

Education:

PhD Applied Mathematics, Leeds, 1995.

Dipl. Ing. Mechanik, Darmstadt (Germany), 1992.

Career:

since 12/2006 Professor of Applied Mathematics.

09/2002-11/2006 Reader in Applied Mathematics.

01/2001-12/2005 EPSRC Advanced Research Fellow.

09/1998 - 09/2002 Lecturer in Applied Mathematics, Department of Mathematics, University of Manchester.

10/1996 - 09/1998 Research Associate at the Department of Applied Mathematics and Theoretical Physics, University of Cambridge.

09/1995 - 10/1996 Research Affiliate at the MIT Fluid Mechanics Laboratory, Cambridge, Massachusetts.

Research Interests:

Computational Mechanics and Biomechanics; Fluid-structure interaction problems; Finite element problems; Large displacement shell theory; Experimental methods

“I 'm an applied mathematician, meaning that I'm interested in 'real world problems' that benefit from being analysed using theoretical/mathematical models. I have done a lot of work on problems involving the interaction between elastic bodies and viscous fluids, often motivated by physiological flow problems such as

the dynamics of the liquid lining in the pulmonary airways. I'm particularly keen on problems that require the use of new and clever numerical techniques and I spend a lot of time developing and implementing such methods in our group's scientific computing library “[oomph-lib](#)” which is developed and maintained jointly with my colleague Andrew Hazel. We and others have used the library for a wide range of problems, including the modelling of free-surface flow of chocolate (joint work with an industrial collaborator from Birmingham), and underwater acoustics problems (again with an industrial collaborator). More recently I've been involved in a project concerned with modelling the melting of debris-covered glaciers.”

Selected Publications:

- Heil, M. & Pedley, T.J. (1995) Large Axisymmetric Deformations of a Cylindrical Shell Conveying a Viscous Flow. *Journal of Fluids and Structures* 9, 237-256.
- Heil, M. (1996) The Stability of Cylindrical Shells Conveying Viscous Flow. *Journal of Fluids and Structures* 10, 173-196.
- Heil, M. & Pedley, T.J. (1996) Large Post-Buckling Deformations of Cylindrical Shells Conveying Viscous Flow. *Journal of Fluids and Structures* 10, 565-599.
- Heil, M. (1997), Stokes Flow in Collapsible Tubes -- Computation and Experiment. *Journal of Fluid Mechanics* 353, 285-312.
- Heil, M. (1998) Stokes Flow in an Elastic Tube -- A Large-Displacement Fluid-Structure Interaction Problem. *The International Journal for Numerical Methods in Fluids* 28, 243-265.
- Heil, M. (1999) Minimal Liquid Bridges in Non-Axisymmetrically Buckled Elastic Tubes. *Journal of Fluid Mechanics* 380, 309-337.
- Heil, M. (1999) Airway Closure: Liquid Bridges in Strongly Buckled Elastic Tubes. *ASME Journal of Biomechanical Engineering* 121, 487-493.
- Heil, M. (2000) Finite Reynolds number effects in the propagation of an air finger into a liquid-filled flexible-walled channel. *Journal of Fluid Mechanics* 424, 21-44
- Heil, M. & White, J.P. (2002) Airway Closure: Surface-tension-driven non-axisymmetric instabilities of liquid-lined elastic rings. *Journal of Fluid Mechanics* 462, 79-109.
- Heil, M. & Jensen, O.E. (2003) Flows in deformable tubes and channels -- Theoretical models and biological applications. Chapter 2 of: *Flow in Collapsible Tubes and Past Other Highly Compliant Boundaries*. Eds: T.J. Pedley and P.W. Carpenter. pp. 15-50. Kluwer, Dordrecht, Netherlands.
- Jensen, O.E. & Heil, M. (2003) High-frequency self-excited oscillations in a collapsible-channel flow. *Journal of Fluid Mechanics* 481 235-268.
- Hazel, A. L. & Heil, M. (2003) Steady finite-Reynolds-number flows in three-dimensional collapsible tubes. *Journal of Fluid Mechanics* 486 79-103.
- Heil, M. (2004) An efficient solver for the fully-coupled solution of large-displacement fluid-structure interaction problems. *Computer Methods in Applied Mechanics and Engineering*. 193 1-23.
- White, J.P. & Heil, M. (2005) Three-dimensional instabilities of liquid-lined elastic tubes -- a lubrication theory model. *Physics of Fluids* 17
- Hazel, A. L. & Heil, M. (2005) Surface-tension-induced buckling of liquid-lined elastic tubes -- a model for pulmonary airway closure. *Proceedings of the Royal Society A* 461, 1847-1868
- Heil, M. & Waters, S.L. (2008) How rapidly oscillating collapsible tubes extract energy from a viscous mean flow. *Journal of Fluid Mechanics* 601, 199-227.
- Heil, M., Hazel, A.L. & Boyle, J. (2008) Solvers for large-displacement fluid-structure interaction problems: Segregated vs. monolithic approaches. *Computational Mechanics* 43, 91-101.

- Heil, M., Hazel, A.L. & Smith, J.A. (2008) The Mechanics of Airway Closure *Respiratory Physiology & Neurobiology* 163, 214-221
- 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
- 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*
- 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.
- 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.
- 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
- 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. pp. 280-311.