

Curriculum vitæ

FAISAL AMLANI

Native fluency in English, working proficiency in French

French Qualification Section 26 (depuis 2016)

Permis de conduire B

Education

2013 PhD in applied mathematics, California Institute of Technology (Caltech), USA

Title: "A new high-order Fourier continuation-based elasticity solver for complex three-dimensional geometries".

Advised by Prof OSCAR P. BRUNO (applied mathematics).

Jury of Profs GUILLAUME BLANQUART (mechanics), DANIEL MEIRON (aeronautics, applied mathematics) and HOUMAN OWHADI (applied mathematics, control & dynamical systems).

Took classes in real, complex and functional analysis; theory, numerics in dynamical systems, PDEs and linear algebra; probability, statistics and optimization.

2006 BA with highest honors (*summa cum laude*) in applied mathematics, Rice University, USA

Research projects advised by MATTHIAS HEINKENSCHLOSS (applied mathematics) and ALEX RIMBERG (physics).

Took classes in pure and applied mathematics; theory, laboratory physics, biology and chemistry.

Research and work experience

2019- Medical Flow Physics Lab at the University of Southern California, USA

Visiting Research Scholar in the Department of Aerospace and Mechanical Engineering with Prof NIEMA PAHLEVAN on hemodynamics including optimization and inverse problems in cardiovascular physiology; held between Paris, France and Los Angeles, USA.

2017-2018 POEMS at the École Nationale Supérieure de Techniques Avancées (ENSTA-ParisTech), France

Postdoctoral research with Dr STÉPHANIE CHAILLAT on anisotropic refinement for BEMs applied to wave propagation in acoustics and solids.

2016 REO group at Sorbonne Universités INRIA-Paris, LJLL - Paris VI, France

Postdoctoral research with Dr MIGUEL FERNÁNDEZ on fracture of thin structures in fluids with biomedical applications to cell rupture and drug delivery in blood flow.

2013-2015 Stabilis Inc. (now Aeromana Inc.), USA

Co-founder and *CTO, experimentalist, electrical/controls scientist* in an R&D startup company for novel methods of active aerodynamic flow control.

2007-2013 Department of Applied & Computational Mathematics at Caltech, USA

Doctoral research on a high-performance spectral method for 3D time-domain elastic wave propagation applied to materials (guided waves) and seismology (earthquakes).

Independent collaboration in Fluid Structure Interaction modeling of arterial networks with Prof NIEMA PAHLEVAN (heart scientist at the University of Southern California, USA).

Funded by *Gordon & Betty Moore Fellowship* and six-year *teaching assistantship*.

Sum 2005 Simulation-Driven Optimization Group at Rice University, USA

NSF fellowship with Prof MATTHIAS HEINKENSCHLOSS on optimal sensor placement for time reconstructions of the 2D advection-diffusion equation for gaseous flow.

Sum 2004 LLNL group at Institute for Pure & Applied Mathematics (IPAM-UCLA), USA

RIPS fellowship (one of 28 international) on flux-correction methods for the Boltzmann equation in biohazard detection with Lawrence Livermore National Labs.

2003-2004 Rimberg lab in Physics & Astronomy at Rice University, USA

Paid *research assistantship* with Prof ALEX RIMBERG (now at Dartmouth College) on methods for optimal design of impedance circuits for single electron transistors.

Teaching experience

2018 *Outils mathématiques pour l'ingénieur (calcul intégral et différentiel)* at École des Ponts, France
10h total—A first-year *petite classe* (cours+TD) for 25 students with Prof ÉRIC CANCÈS.

2007-2013 *Complex variables, ordinary and partial differential equations* at Caltech, USA

900h total—Managing (head) assistant for a mandatory course sequence with Profs OSCAR BRUNO, THOMAS HOU, DAN MEIRON, HOUMAN OWHADI, NILES PIERCE.

Delivering substitute lectures and in-class reviews to the main class (~220 students); designing curricula and writing problems, solutions, handouts for all (10) sections; managing teaching assistants.

2005 *Theoretical neuroscience* at Rice University and Baylor College of Medicine, USA

30h total—Exercises and labs for grad-level mathematical neuroscience with Prof STEVE COX.

2004, 2005 *Differential equations in science and engineering* at Rice University, USA

90h total—Exercises for third-year analysis of ODEs/PDEs in diffusion and wave propagation with Profs LILIANA BORCEA, E. MCKAY HYDE, DMITRIY LEYKEKHMAN.

Papers and patents

2019e PAHLEVAN and AMLANI, "Multiharmonic intrinsic frequency analysis with high-order simulations for heart-based monitoring", in preparation.

2019d AMLANI, CHAILLAT and LOSEILLE, "High-order metric-based anisotropic mesh adaptation for 3D acoustic boundary element methods", preprint* to be submitted (16 pages).

2019c BHAT, AMLANI *et al.*, "Unraveling a new mechanism for tsunami generation due to supershear earthquakes", preprint to be submitted to *Nature* (10 pages).

2019b AMLANI, BRUNO, LÓPEZ-VÁZQUEZ *et al.*, "Transient propagation and scattering of quasi-Rayleigh waves in plates: quantitative comparison between pulsed TV-holography measurements and numerical simulations", preprint* to be submitted to *Mechanical Systems and Signal Processing* (21 pages).

- 2019a AMLANI and PAHLEVAN, "A Fourier continuation-based hemodynamics solver", submitted* to *Journal of Computational Physics* (25 pages).
- 2018 AMLANI, CHAILLAT and LOSEILLE, "An efficient preconditioner for adaptive fast boundary element methods to model 3D wave propagation", Accepted* to *Computer Methods in Applied Mechanics and Engineering* (25 pages).
- 2016 AMLANI and BRUNO, "An FC-based spectral solver for elastodynamic problems in general three-dimensional domains", *Journal of Computational Physics* 307 (21 pages).
- 2015 AMLANI, MILLER and LOMBARDINI, "Dynamically controllable force generating device", *U.S. and International Patents US20160327073* and *WO2016179405* (33 pages).
- 2011 PAHLEVAN, AMLANI et al., "A physiologically relevant, simple outflow boundary model for truncated vasculature", *Annals of Biomedical Engineering* 39,5 (12 pages).
- 2010 LÓPEZ-VÁZQUEZ, AMLANI et al., "Numerical modeling and measurement by pulsed television holography of ultrasonic displacement maps in plates with through-thickness defects", *Optical Engineering* 49,9 (10 pages).
- 2009 LÓPEZ-VÁZQUEZ, AMLANI et al., "Modeling for characterizing defects in plates using two-dimensional maps of instantaneous ultrasonic out-of-plane displacement obtained by pulsed TV-holography", *SPIE Optical Measurement Systems for Industrial Inspection VI* 7389 (12 pages).

* Author copy available upon request.

Invited talks and conference presentations

On 3D boundary element methods for wave propagation.

- 2018 Talk at the *2018 Symposium of IABEM* (June 26-28), Sorbonne (Jussieu), France
- 2017e Invited talk at *JJC Ondes (journées jeunes chercheurs)* (Nov 20-21), Sorbonne (Jussieu), France
- 2017d Talk at the *1st Paris-London BEM Workshop* (June 19-20), University College London, UK
- 2017c Talk at the *5th BEM on the Saar* workshop (May 29-31), Universität des Saarlandes, Germany
- 2017b Talk at the *2017 WAVES* conference (May 15-19), University of Minnesota, USA

On Fourier continuation methods for 3D elastodynamics.

- 2017a Talk at the *2017 WAVES* conference (May 15-19), University of Minnesota, USA
- 2015b Invited seminar, Département de Sismologie, Institut de Physique du Globe de Paris (IPGP), France

On other topics.

- 2015a Invited lecture on "delay differential equations for clinical applications in respiratory physiology", Department of Medical Engineering at Caltech, USA
- 2006 Poster on "optimized sensor location for 2D advection-diffusion equations using proper orthogonal decompositions", *NSF-VIGRE Symposium*, Rice University, USA
- 2004 Invited talk on "flux corrections for the Boltzmann equation", Center for Applied Scientific Computing at Lawrence Livermore National Laboratory, USA

Awards and fellowships

- 2014 *W.P. Carey Prize* (department-wide) for "most outstanding doctoral dissertation in pure mathematics or applied mathematics" from Caltech, USA
- 2014 *Demetriades-Tsafka-Kokkalis Prize* (university-wide) for "best thesis, publication or discovery" in seismology/seismo-engineering from Caltech, USA
- 2011 *Distinction in Teaching* (department-wide) in applied mathematics from Caltech, USA
- 2006-2007 *Gordon & Betty Moore Fellowship* (university-wide) from Caltech, USA
- 2002-2006 *Trustee Distinguished Scholarship* (university-wide) from Rice University, USA
- 2005 *REU Research Fellowship* from the National Science Foundation, USA
- 2004 *RIPS Research Fellowship* at the Institute for Pure & Applied Mathematics, USA
- 2004 *Tom Bonner Book Prize* (university-wide) for "most outstanding student in physics" from Rice University, USA

Professional activities, committees and memberships

- 2012-2013 *Committee* for inviting and hosting speakers for weekly seminars at Caltech
- 2012,2013 *Admissions review of applications* to applied mathematics PhD programs at Caltech
- 2005-2006 *Secretary and Undergrad Representative* for Rice SIAM Graduate Student Chapter
- Member of the *American Mathematical Society* (AMS), the *Society for Industrial & Applied Mathematics* (SIAM)

Technical languages

C/C++, Fortran, Python, Arduino (Microcontroller), MATLAB, Mathematica, High Performance Computing (multithreading and multiprocessing)

References

Available upon request.