CURRICULUM VITAE & RECENT PUBLICATIONS

Giuseppe Vacca

Place and date of birth: Bitonto, 22-06-1986
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Research interests

Polytopal Methods for PDEs: Virtual Element Methods (VEM).
My research activity focuses on:

- study of the divergence-free Virtual Elements for fluid dynamics, including higly convection dominated problems and fluid-structure interaction problems;

- analysis of the theoretical aspects of VEM related to the interpolation estimates in the presence of complex meshes (curved elements, elements with small edges, elements with many edges);

- Adaptivity for VEM;

- VEM discretizations of elliptic eigenvalue problems.

Education

- 04-2016: **PhD in Mathematics** Department of Mathematics, University of Bari.

- 09-2012: **Master Degree in Mathematics** University of Pisa.

- 07-2009: **Bachelor Degree in Mathematics** University of Pisa.

Academic career

- 09-2019: Italian national habilitation for the role of **associate professor** in Numerical Analysis until 09-2028.

- 07-2021–now: **Assistant Professor (RTD B) in Numerical Analysis**,
  Department of Mathematics, University of Bari.

- 06-2019–06-2021: **Research Fellow (RTD A) in Numerical Analysis**,
  Department of Mathematics and Application, University of Milano-Bicocca.

- 07-2016–05/2019: **Post-Doc researcher**,
  Department of Mathematics and Application, University of Milano-Bicocca,
  within the project "Sviluppo e analisi del metodo agli Elementi Finiti Virtuali".

Prizes and awards

- 10-2017: **Premio Giovani Talenti 2017– Third place**
  Prize issued by the University of Milano-Bicocca and the Accademia Nazionale dei Lincei for researchers under 36 years of age.

- 03-2017: **Premio SIMAI for the best PhD thesis**
  Italian candidate by the SIMAI (Italian Society for Industrial and Applied Mathematics) for the ECCOMAS PhD Award for the best PhD thesis on Computational Methods in Applied Sciences and Engineering.

- 07-2015: **Premio Fondazione MINTAS**
  Prize issued by the Biomedical University Residence Santa Caterina da Siena, Pavia.

Grants

- **Finanziamento Giovani Ricercatori 2015-2016 GNCS**,

- **Finanziamento Giovani Ricercatori 2014-2015 GNCS**.

- Participation to the **GNCS project 2020** BendVEM (PI F.Dassi) in a team including members of the present project.

Publications (Last five years)

- **Journals**

  1. G. Vacca, L. Beirão da Veiga, Virtual Element Methods for parabolic problems on polygonal meshes, *Numerical Methods for Partial Differential Equations*, 31(6):2110-2134 (2015).

  2. L. Lopez, G. Vacca, Spectral Properties and Conservation Laws in Mimetic Finite Difference Methods for PDEs, *Journal of Computational and Applied Mathematics*, 292:760-784 (2016).

  3. L. Beirão da Veiga, C. Lovadina, G. Vacca, Divergence free Virtual Elements for the Stokes problem on polygonal meshes, *Mathematical Modelling and Numerical Analysis*, 51(2):509-535 (2017).

  4. G. Vacca, Virtual Element Methods for hyperbolic problems on polygonal meshes, *Computers & Mathematics with Applications*, 74(5):882-898 (2017).

  5. L. Beirão da Veiga, L. Lopez, G. Vacca, Mimetic Finite Difference methods for Hamiltonian wave equations in 2D, *Computers & Mathematics with Applications*, 74(5):1123-1141 (2017).

  6. F. Gardini, G. Vacca, Virtual Element Method for Second Order Elliptic Eigenvalue Problems, *IMA Journal of Numerical Analysis*, 38(4):2026--2054 (2018).

  7. G. Vacca, An H^1-conforming virtual element for Darcy and Brinkman equations, *Mathematical Models and Methods in Applied Sciences*, 28(1):159-194 (2018).

  8. L. Beirão da Veiga, C. Lovadina, G. Vacca, Virtual Elements for the Navier-Stokes problem on polygonal meshes, *SIAM Journal on Numerical Analysis*, 56(3):1210-1242 (2018).

  9. O. Certik, F. Gardini, G. Manzini, G. Vacca, The virtual element method for eigenvalue problems with potential terms on polytopal meshes, *Applications of Mathematics*, 63(3):333-365 (2018).

  10. L. Beirão da Veiga, A. Russo, G. Vacca, The Virtual Element Method with curved edges, *Mathematical Modelling and Numerical Analysis*, 53(2):375 - 404 (2019).

  11. F. Gardini, G. Manzini, G. Vacca, The nonconforming virtual element method for eigenvalue problems, *Mathematical Modelling and Numerical Analysis*, 53(3):749 - 774 (2019).

  12. L. Beirão da Veiga, D. Mora, G. Vacca, The Stokes complex for Virtual Elements with application to Navier–Stokes flows, *Journal of Scientific Computing*, 81(2):990 - 1018 (2019).

  13. F. Dassi, G. Vacca, Bricks for the mixed high-order virtual element method: projectors and differential operators, *Applied Numerical Mathematics*, 155:140 - 159 (2020).

  14. O. Certik, F. Gardini, G. Manzini, L. Mascotto, G. Vacca, The p- and hp-versions of the virtual element method for elliptic eigenvalue problems, *Computers & Mathematics with Applications*, 79(7):2035 - 2056 (2020).

  15. L. Beirão da Veiga, F. Dassi, G. Vacca, The Stokes complex for Virtual Elements in three dimensions, *Mathematical Models and Methods in Applied Sciences*, 30(3):477-512 (2020).

  16. L. Beirão da Veiga, A. Pichler, G. Vacca, A virtual element method for the miscible displacement of incompressible fluids in porous media, *Computer Methods in Applied Mechanics and Engineering*, 373: 113649 (2021).

  17. L. Beirão da Veiga, C. Canuto, R. H. Nochetto, G. Vacca, Equilibrium analysis of an immersed rigid leaflet by the virtual element method, *Mathematical Models and Methods in Applied Sciences*, 31(7):1323-1372 (2021).

  18. F. Dassi, A. Fumagalli, D. Losapio, S. Scialó, A. Scotti, G. Vacca, The Mixed Virtual Element Method on curved edges in two dimensions, *Computer Methods in Applied Mechanics and Engineering*, 368: 114098(2021).

  19. L. Beirão da Veiga, F. Dassi, C. Lovadina, G. Vacca, SUPG-stabilized Virtual Elements for diffusion-convection problems: a robustness analysis, *Mathematical Modelling and Numerical Analysis*, 55:2233-2558 (2021).

20. L. Beirão da Veiga, F. Dassi, G. Vacca, Vorticity-stabilized Virtual Elements for the Oseen Equation, *Mathematical Models and Methods in Applied Sciences*, 31(14):3009-3052 (2021).

21. F. Dassi, A. Fumagalli, I. Mazzieri, A. Scotti, G. Vacca, A Virtual Element Method for the wave equation on curved edges in two dimensions, *Journal of Scientific Computing*, 90(1): 50 (2022).

22. P. F. Antonietti, S. Scacchi, G. Vacca, M. Verani, C^1-VEM for some variants of the Cahn-Hilliard equation: a numerical exploration, *Discrete & Continuous Dynamical Systems - S*, (2022).

23. L. Beirão da Veiga, G. Vacca, Sharper error estimates for Virtual Elements and a bubble-enriched version. To appear in *SIAM Journal on Numerical Analysis* (2022).

- **Conference Papers**

  1. F. Dassi, A. Fumagalli, D. Losapio, S. Scialó, A. Scotti, G. Vacca, The mixed virtual element method for grids with curved interfaces in single-phase flow problems. *Society of Petroleum Engineers - SPE Reservoir Simulation Conference 2021*, (2021).

- **Book chapters**

  1. L. Beirão da Veiga, G. Vacca, Divergence free VEM for the Stokes problem with no internal degrees of freedom, *Current Trends and Open Problems in Computational Mechanics*, Springer International Publishing (2022).

  2. L. Beirão da Veiga, G. Vacca, An introduction to second order divergence-free VEM for fluidodynamics, *The Virtual Element Method and its Applications*, SEMA SIMAI Springer Series (2022).

- **Submitted for publication in journal**

  1. L. Beirão da Veiga, C. Canuto, R. H. Nochetto, G. Vacca, M. Verani, Adaptive VEM: Stabilization-Free A Posteriori Error Analysis. arXiv:2111.07656 (2021).

  2. F. Dassi, A. Fumagalli, A. Scotti, G. Vacca, Bend 3d Mixed Virtual Element Method for Elliptic Problems. arXiv:2111.10644 (2021).

Invited talks

A total of 36 invited talks at international conferences or seminars on invitation in foreign departments. I here list only the recent talks:

1. 04-2022: Calcolo Scientifico e Modelli matematici alla ricerca delle cose nascoste attraverso le cose manifeste, Roma (Italy)

2. 07-2021: SIAM Conference on Mathematical & Computational Issues in the Geosciences, Milano (Italy)

3. 05-2021: INdAM Workshop Polygonal methods for PDEs, Roma (Italy)

4. 03-2021: SIAM Conference on Computational Science and Engineering 2021, Fort Worth (Texas-USA)

5. 01-2021: WCCM –ECCOMAS Congress 2020, Paris (France)

Mid-long visiting periods

- April-May 2019: **University of Maryland** College Park (Maryland-USA),
  invitation Prof. R. Nochetto.

Advisor Activity

- 2 Master students and 1 Bachelor student, University of Milano-Bicocca.

- Reviewer and examiner of 1 PhD Thesis.

Organization activity

- Member of the organizing committee of the **Bari Numerics Day 2021**, Bari (Italy).

- Member of the organizing committee of the **Workshop POEMS 2017**, Milano (Italy).

- Co-organizer of Minisympisia in International Conferences
    - **SIMAI 2020 conference**, Parma (Italy)
      Minysimposium "Advances in polygonal and polyhedral methods".
    - **14th WCCM and ECCOMAS Congress 2020**, Paris (France)
      Minisymposium "Advances in polygonal and polyhedral methods".
    - **Workshop WONAPDE 2019** Concepción (Chile)
      Minisymposium "Recent advancements in polygonal methods".

Referee & Editorial Activity

- **Reviewer** for many international journals in the field of numerical analysis.

- **Project Referee** for Chilean National Fund for Scientific and Technological Research.

- **Guest Editor** for: Applied Numerical Mathematics, Journal of Computational Dynamics.

Bibliometric Data (Scopus)

- **Documents: 23**,

- **Citations: 624**,

- **H-index: 14**.

Bari, May 2, 2022.

Giuseppe Vacca