

Vito Zago

Curriculum Vitae et Studiorum

Posizione attuale: Researcher, Istituto Nazionale di Geofisica e Vulcanologia.

Contratti di ricerca

- Mar 2022 – Nov 2022 Postdoctoral Research Fellow, Applied Physics Laboratory, University of Washington, Seattle, WA, USA.
Tema di ricerca: High-resolution numerical modeling of a multi-body WEC system interacting with surface gravity waves using Smoothed Particle Hydrodynamics (SPH) method.
- Mar 2019 – Feb 2022 Postdoctoral Research Fellow, Department of Civil and Environmental Engineering, Northwestern University, Evanston, IL, USA.
Tema di ricerca: Wave forces on Offshore Structures Calculated with Smoothed Particle Hydrodynamics and physical modeling.
- Nov 2018 – Feb 2019 Assegno Professionalizzante, TecnoLab, Osservatorio Etneo, Istituto Nazionale di Geofisica e Vulcanologia, Catania.
Tema di ricerca: Modellazione fisicomatematica di flussi geofisici complessi con metodi particellari guidati da dati satellitari per la valutazione della pericolosità vulcanica.

Formazione

- 1 Nov 2015 - 7 Gen 2019 **Dottorato di ricerca** in Ingegneria dei Sistemi, Energetica, Informatica e delle Telecomunicazioni, Università degli Studi di Catania in unione con l'Istituto Nazionale di Geofisica e Vulcanologia, Osservatorio Etneo.
Titolo tesi: "Smoothed Particle Hydrodynamics method and flow dynamics: the case of lava numerical modeling and simulation"
- 23 Lug 2015 **Laurea Magistrale**, Automation Engineering and Control of Complex Systems, Università degli Studi di Catania. Votazione: 110/110 e lode.
- 23 Lug 2013 **Laurea Triennale**, Ingegneria Elettronica, Università degli Studi di Catania. Votazione: 110/110 e lode.

Partecipazione a progetti di ricerca

- 2019 – 2022 *Project title:* Wave forces on offshore structures calculated with Smooth Particle Hydrodynamics and physical modeling.
Project sponsor: Kuwait Foundation for the Advancement of Sciences.
Sponson Award Number: PR18-15EV-05
- 2015 – 2019 Programma di ricerca ATHOS, Presso TechnoLab, Osservatorio Etneo, INGV.

Abilitazioni professionali

26 Gen 2017 Abilitazione professionale alla Professione di Ingegnere – Sezione Industriale.
Dic 2016 Abilitazione professionale alla Professione di Ingegnere – Sezione Informazione.

Servizio Istituzionale

- Chairman della keynote *Use of SPH for large multiscale and multiphysics simulation of industrial, geophysical and biophysical applications*, Dr. Paul Cleary, 16th SPHERIC Conference, Istituto Nazionale di Geofisica e Vulcanologia, Italia, June 6–9, 2022.
- Convener della sessione *Volcano Hazard Modeling* at the EGU general assembly 2021.
- Convener della sessione *Volcano Hazard Modeling* at the EGU general assembly 2020.
- Convener della sessione *Volcano Hazard Modeling* at Cities on Volcanoes 2020.

Supervisione

2021-2022 *Ilan Y. Gasko*, winter project, Tema di ricerca: “Modeling Vertical Transport of a Clast up a Cliff Face With GPUSPH”. Presso: Northwestern University, Evanston, Department of Civil and Environmental Engineering.

2020-2021 *Lennart J. Schulze*, Tesi magistrale. Titolo tesi: “Kernel Gradient correction for free surface water wave propagation with Smoothed Particle Hydrodynamics”
Affiliazione: Technische Universität München. Presso: Northwestern University, Evanston, Department of Civil and Environmental Engineering.

Periodi di studio e ricerca all'estero

Ottobre 2018 Laboratoire Modélisation Mathématique et Numérique (M2N) del Conservatoire National des Arts et Métiers (CNAM). Invitato dal prof. Alexis Héroult.
Tema di ricerca: Sviluppo di modelli di bordo SPH per l'applicazione di condizioni al contorno termiche.

Feb – Mar 2018 Northwestern University, department of Civil and Environmental Engineering, Evanston, IL (USA). Prof. R. A. Dalrymple.
Tema di ricerca: Development of open boundary conditions for Lagrangian particle methods.

Apr – Giu 2017 Department of Civil, Construction and Environmental Engineering della North Carolina State University (USA). Invitato dal prof. Billy Edge.
Tema di ricerca: Implementazione in GPUSPH di un modello di riscaldamento viscoso.

Sett – Nov 2016 Laboratoire Modélisation mathématique et numérique (M2N) del Conservatoire National des Arts et Métiers (CNAM). Invitato dal prof. Alexis Héroult.
Tema di ricerca: Sviluppo di uno schema di integrazione semi-implicito per GPUSPH.

Apr – Mag 2016 Department of Civil, Construction and Environmental Engineering della North Carolina State University (USA). Invitato dal prof. Billy Edge.
Tema di ricerca: Implementazione in GPUSPH di un modello di reologia dipendente da temperatura.

Publicazioni su rivista

- A1. Zago, V., L. J. Schulze, G. Bilotta, N. Almashan, R. A. Dalrymple (2021). *Overcoming excessive numerical dissipation in SPH modeling of water waves*, Coastal Engineering, 170. doi:10.1016/j.coastaleng.2021.104018.
- A2. Saikali, E., G. Bilotta, A. H  rault, V. Zago (2020). *Accuracy Improvements for Single Precision Implementations of the SPH Method*. International Journal of Computational Fluid Dynamics, 34, (10). doi:10.1080/10618562.2020.1836357
- A3. Del Negro, C., A. Cappello, G. Bilotta, G. Ganci, A. H  rault, V. Zago (2020). *Living at the edge of an active volcano: Risk from lava flows on Mt. Etna*. GSA Bulletin, 132 (78): 1615–1625. doi:10.1130/B35290.1.
- A4. Zago, V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault, C. Del Negro (2019). *Preliminary validation of lava benchmark tests on the GPUSPH particle engine*. Annals of Geophysics, 62, 2. doi:10.4401/ag7870.
- A5. Cappello, A., G. Ganci, G. Bilotta, A. H  rault, V. Zago, C. Del Negro (2019). *Satellite driven modeling approach for monitoring lava flow hazards during the 2017 Etna eruption*. Annals of Geophysics, 62, 2. doi:10.4401/ag7792.
- A6. Ganci, G., A. Cappello, V. Zago, G. Bilotta, A. H  rault, C. Del Negro (2019). *3D Lava flow mapping of the 17–25 May 2016 Etna eruption using tristereo optical satellite data*. Annals of Geophysics, 62, 2. doi:10.4401/ag7875.
- A7. V. Zago, G. Bilotta, A. H  rault, R. A. Dalrymple, L. Fortuna, A. Cappello, G. Ganci, C. Del Negro (2018). *Semiimplicit 3D SPH, on GPU for lava flows*. Journal of Computational Physics. doi:10.1016/j.jcp.2018.07.060.
- A8. Ganci, G., A. Cappello, G. Bilotta, A. H  rault, V. Zago, C. Del Negro (2018). *Mapping Volcanic Deposits of the 2011–2015 Etna Eruptive Events Using Satellite Remote Sensing*. Frontiers in Earth Science, 6:83. doi: 10.3389/feart.2018.00083.
- A9. V. Zago, G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault, C. Del Negro (2017). *Simulating complex fluids with Smoothed Particle Hydrodynamics*, Annals of Geophysics, 60(6), PH669. doi:10.4401/ag7362

Libri e capitoli di libro

- B1. Bilotta G., A. H  rault, V. Zago. *Design and implementation of particle systems for mesh free methods with high performance*, High Performance Parallel Computing, ISBN 9789535164340.
- B2. Buscarino A., L. Fortuna, M. Frasca, M. Lombardo, V. Zago, *Solution Manual of Essentials of Non linear Circuit Dynamics with MATLAB   and Laboratory Experiments*.

Atti di Convegno

- C1. Zago, V., N. Almashan, R. A. Dalrymple, G. Bilotta, D. AlHouti, S. Neelamani, *Validation of an SPHFEM model for offshore structures*. Proceedings of the 16th SPHERIC Conference, Istituto Nazionale di Geofisica e Vulcanologia, June 6–9, 2022. ISBN: 9791280282057.
- C2. Schulze, L. J., V. Zago, G. Bilotta, R. A. Dalrymple, *Localized kernel gradient correction for SPH simulations of water wave propagation*. Proceedings of the 16th SPHERIC Conference, Istituto Nazionale di Geofisica e Vulcanologia, June 6–9, 2022. ISBN: 9791280282057.
- C3. Zago, V., L. J. Schulze, G. Bilotta, N. Almashan, R. A. Dalrymple, *A conservative Corrective SPH for water wave propagation*. Proceedings of the 15th SPHERIC Conference, New Jersey Institute of Technology, June 8–11, 2021. ISBN: 9780578919348.
- C4. Bilotta, G., V. Zago, V. Centorrino, A. H  rault, R. A. Dalrymple, C. Del Negro. *Improvements to a semiimplicit integration scheme for viscous fluids in SPH*. Proceedings of the 15th

SPHERIC Conference, New Jersey Institute of Technology, June 8–11, 2021. ISBN: 9780-578919348.

- C5. Zago V., R. A. Dalrymple, G. Bilotta, A. Cappello, G. Ganci, C. Del Negro, A. Hérault, N. Al Mashaan. *Coupling SPH and FEM analysis in GPUSPH for the study and design of offshore plat forms*. Proceedings of the 14th SPHERIC Conference, Exeter, England, June 2527, 2019. ISBN: 9780902746442.
- C6. Bilotta, G., V. Zago, A. Hérault, E. Saikali, R. A. Dalrymple. *Bigger, cleaner, faster: notes on the implementation of a powerful, flexible, highperformance SPH computational engine*. Proceedings of the 14th SPHERIC Conference, Exeter, England, June 2527, 2019. ISBN: 9780902746442.
- C7. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. Hérault and C. Del Negro. *Benchmarking of the GPUSPH particle engine on lava flows*. Proceedings of the 13th SPHERIC Conference, Galway, Ireland, June 2628, 2018. ISBN: 9781908358592.
- C8. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. Hérault and C. Del Negro. *Implicit integration of the viscous term and GPU implementation in GPUSPH for lava flows*. Proceedings of the 12th SPHERIC Conference, Ourense, Spain, June 1315, 2017. ISBN: 9788469736784.

Note su invito

- D1. Zago V., *SPH simulations of geophysical flows: flexibility of the method and recent advances*. 107° congresso nazionale, Società Italiana di Fisica, September 13–17, 2021.

Conferenze

- E1. Zago V., S. Branca, C. Del Negro, L. Fortuna, *On the physical models and numerical algorithms for the simulation of lava flows and their interaction with the topography and structures*, 5^a conferenza A. Rittmann, Catania, 29 Settembre – 1 Ottobre 2022. Poster.
- E2. Zago, V., N. Almashan, R. A. Dalrymple, G. Bilotta, D. AlHouti, S. Neelamani, *Validation of an SPHFEM model for offshore structures*. 16th SPHERIC Conference, Istituto Nazionale di Geofisica e Vulcanologia, Italia, June 6–9, 2022. Orale.
- E3. Schulze, L. J., V. Zago, G. Bilotta, R. A. Dalrymple, *Localized kernel gradient correction for SPH simulations of water wave propagation*. 16th SPHERIC Conference, Istituto Nazionale di Geofisica e Vulcanologia, Italia, June 6–9, 2022. Orale.
- E4. Zago, V., L. J. Schulze, G. Bilotta, N. Almashan, R. A. Dalrymple, *A conservative Corrective SPH for water wave propagation*. 15th SPHERIC Conference, New Jersey Institute of Technology, June 8–11, 2021. Orale.
- E5. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. Hérault and C. Del Negro. *Versatility of the SPH method in the simulation of lava environment interactions*. AGU Fall meeting 2021, Presentazione eLightning.
- E6. Bilotta G., A. Cappello, V. Zago, G. Ganci, *Advances in Modeling for Natural Hazards and Risk*. AGU Fall meeting 2021, Presentazione eLightning.
- E7. Bilotta G., V. Zago, A. Hérault, A. Ghaïtanellis, A. Cappello, G. Ganci, *Particle methods for geo physical flows: recent advancements in GPUSPH*, AGU Fall meeting 2021. Poster.
- E8. Bilotta, G., V. Zago, V. Centorrino, A. Hérault, R. A. Dalrymple, C. Del Negro, *Improvements to a semiimplicit integration scheme for viscous fluids in SPH*. 15th SPHERIC Conference, New Jersey Institute of Technology, June 8–11, 2021. Orale.
- E9. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. Hérault and C. Del Negro. *SPH model for the simulation of lava buildings interactions*. EGU general assembly 2021. Orale.
- E10. Zago V., R. A. Dalrymple, G. Bilotta, A. Cappello, G. Ganci, C. Del Negro, A. Hérault, N. Al Mashaan. *Coupling SPH and FEM analysis in GPUSPH for the study and design of offshore*

platforms. 14th SPHERIC Conference, University of Exeter, England, June 25–27, 2019. Orale.

- E11. Bilotta, G., V. Zago, A. H  rault, E. Saikali, R. A. Dalrymple. *Bigger, cleaner, faster: notes on the implementation of a powerful, flexible, highperformance SPH computational engine*. 14th SPHERIC Conference, University of Exeter, England, June 25–27, 2019. Orale.
- E12. Del Negro C., G. Ganci, A. Cappello, V. Zago, G. Bilotta, A. H  rault. *The 2011 eruption of Nabro volcano: a retrospective analysis through the combined use of satellite data and lava flow modelling*. AGU Fall Meeting, Washington, December 10–14, 2018. Poster.
- E13. Del Negro C., G. Bilotta, A. Cappello, G. Ganci, A. H  rault, V. Zago. *Quantifying uncertainties in the modeling of lava flow hazards*. 104   Congresso Nazionale della Soci  t   Italiana di Fisica, Rende, September 17–21, 2018. Orale.
- E14. Bilotta G., A. Cappello, G. Ganci, V. Zago. *Sensitivity of the MAGFLOW cellular automaton for lava flow simulations*. Congresso SGI SIMP, Catania, September 12–14, 2018. Orale.
- E15. Cappello A., G. Ganci, G. Bilotta, V. Zago. *Assessing lava flow hazards at the new Southeast Crater of Etna volcano*, Congresso SGI SIMP, Catania, September 12–14, 2018, Orale.
- E16. Ganci G., G. Bilotta, A. Cappello, V. Zago. *Estimation of uncertainty in lava effusion rate integrating thermal infrared and tristereo optical satellite data*, Congresso SGI SIMP, Catania, September 12–14, 2018, Poster.
- E17. H  rault A., G. Bilotta, V. Zago, *Modeling of Lava Flow Emplacement with Smoothed Particle Hydrodynamics method using Highperformance computing*, Cities on Volcano 10, Napoli, September 2–7, 2018, Poster.
- E18. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Stability of lava eruption modelling with SPH*, Cities on Volcano 10, Napoli, September 2–7, 2018, Poster.
- E19. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Benchmarking of the GPUSPH particle engine on lava flows*. 13th SPHERIC Conference, National University of Ireland, Ireland, June 26–28, 2018, Orale.
- E20. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault, and C. Del Negro. *Validating GPUSPH for the non Newtonian Rayleigh Taylor instability*. NDES 2018, University of Catania, Acireale, June 11–13, 2018, Orale.
- E21. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Implicit integration of the viscous term and GPU implementation in GPUSPH for lava flows*. 12th SPHERIC Conference, Universidade de Vigo, Ourense, Spain, June 13–15, 2017, Orale.
- E22. Ganci G., V. Zago, G. Bilotta, A. Cappello, A. H  rault and C. Del Negro. *Lava Cooling modelled with GPUSPH*, European Geosciences Union (EGU) General Assembly 2017, Vienna, Austria, April 23–28, 2017, Poster.
- E23. Bilotta G., A. Cappello, G. Ganci, V. Zago, A. H  rault and C. Del Negro. *Impact of topographical data uncertainties on the MAGFLOW model for lava flow simulations*. European Geosciences Union (EGU) General Assembly 2017, Vienna, Austria, April 23–28, 2017, Poster.
- E24. Cappello A., G. Ganci, G. Bilotta, A. H  rault, V. Zago and C. Del Negro. *Lava flow hazard at the new SouthEast Crater of Etna volcano*. European Geosciences Union (EGU) General Assembly 2017, Vienna, Austria, April 23–28, 2017, Poster.
- E25. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Advances in the applications of SPH to lava flows*. MeMoVolc 2017, Istituto Nazionale di Geofisica e Vulcanologia Osservatorio Etneo, Catania, Italy, February 21–23, 2017, Orale.
- E26. Ganci G., G. Bilotta, A. Cappello, A. H  rault, V. Zago and C. Del Negro. *Uncertainty quantification in satellitedriven products to forecast lava flow hazards*. MeMoVolc 2017, Istituto Nazionale di Geofisica e Vulcanologia Osservatorio Etneo, Catania, Italy, February 21–23, 2017, Orale.

- E27. Bilotta G., A. H  rault, A. Cappello, G. Ganci, V. Zago and C. Del Negro. *Topographical data uncertainties and their impact on lava flow simulations*. MeMoVolc 2017, Istituto Nazionale di Geofisica e Vulcanologia Osservatorio Etneo, Catania, Italy, February 21–23, 2017, Orale.
- E28. Cappello A., G. Bilotta, G. Ganci, A. H  rault, V. Zago and C. Del Negro. *Lav@Hazard: a web-GIS framework for realtime effusive hazard response at Mt Etna*. MeMoVolc 2017, Istituto Nazionale di Geofisica e Vulcanologia Osservatorio Etneo, Catania, Italy, February 21–23, 2017, Orale.
- E29. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Smoothed Particle Hydrodynamics Method for Multifluid Flows with LavaWater Interaction*. SIMAI 2016, Politecnico di Milano, Milano, Italy, September 13–16, 2016, Orale.
- E30. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Simulating Complex Fluids with Smoothed Particle Hydrodynamics*. COMPENG 2016 Workshop on Complexity in Engineering, Universit   degli Studi di Catania, Catania, Italy, July 4–6, 2016, Orale.
- E31. Zago V., G. Bilotta, A. Cappello, R. A. Dalrymple, L. Fortuna, G. Ganci, A. H  rault and C. Del Negro. *Recent advances in the GPUSPH model for the thermal and rheological evolution of lava flows*. European Geosciences Union (EGU) General Assembly 2016, Vienna, Austria, April 17–22, 2016, Poster.

Seminari

- F1. *Simulating Lava flows and offshore structures with Smoothed Particle Hydrodynamics*. Department of Civil and Environmental Engineering, Northwestern University, Evanston, IL, USA, 15 gennaio 2020.
- F2. *SPH: From Geophysics to Engineering, Versatility of the method and recent advancements*. Applied Physics Laboratory, University of Washington, Seattle, WA, 5 maggio 2022.

Catania, 13 Marzo 2024

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