Théophile Chaumont-Frelet

8 February 1989

theophile.chaumont@inria.fr
(+33) 6 48 10 80 60
22 rue Gambetta, 59370 Mons-en-Barœul, France

tchaumont.github.io

Research interests

Partial differential equations
Numerical analysis
Finite element methods
A posteriori error analysis
High performance computing
Wave propagation
Geophysics
Electromagnetism

Professional history

Since 2023: **Junior researcher** — Inria project-team Rapsodi
Lille, France

2018 - 2023: **Junior researcher** — Inria project-team Atlantis
Sophia-Antipolis, France

2018 - 2018: **Postdoctoral fellow** — CERMICS
Paris, France
Supervision: Alexandre Ern, Virginie Ehrlacher and Anthony Nouy

2016 - 2018: **Postdoctoral fellow** — Basque Center for Applied Mathematics
Bilbao, Spain
Supervision: David Pardo

2012 - 2015: **PhD Student** — INSA Rouen and Inria project-team Magique3D
Rouen, France
Supervision: Christian Gout and Hélène Barucq

Education

2007 - 2012: **Engineering degree** — Insa Rouen
Rouen, France

2011 - 2012: **Master's degree** — University of Rouen
Rouen, France

Training experience

Since 2025:	**Postdoctoral appointment**	of Sumit Mahajan
Since 2022:	**Ph.D. thesis**	of Florentin Proust
2021 - 2022:	**Postdoctoral appointment**	of Josselin Defrance
2019 - 2021:	**Postdoctoral appointment**	of Patrick Vega
2019 - 2022:	**Ph.D. thesis**	of Zakaria Kassali

Project management

2024 - 2027: **ANR JCJC** APOWA
A posteriori error estimates for wave equations

2021 - 2025: **Inria exploratory action** POPEG
Propagation d'Ondes Par États Gaussiens

2019 - 2023: **MATH-AmSud** EOLIS
Efficient offline strategies for multi-query problems

Event organization

2024: **Minisymposium** at CMAM2024
Advances in p- and hp-, and problem oriented Galerkin methods
with: Lorenzo Mascotto

2023: **Minisymposium** at ICOSAHOM2023
High-order methods for wave propagation problems
with: Axel Modave

2023: **Minisymposium** at NACONF2023
Novel discretisation and solution methods for wave propagation problems
with: Victorita Dolean

2022: **Conference** Singular days
in Nice
with: Maxime Ingremeau

2022: **Conference** Recontre JCJC ondes
in Inria Université Côte d'Azur
with: Marcella Bonazzoli, Jérémy Heleine and Pierre Marchand

2022: **Minisymposium** at Eccomas congress 2022
Robust and scalable numerical methods for wave propagation: design, analysis and application
with: Hélène Barucq, Rabia Djelouli and Axel Modave

2022: **Minisymposium** at Conference on Mathematics of Wave Phenomena
Discretization methods for indefinite wave propagation problems
with: Markus Melenk

2021: **Minisymposium** at ICOSAHOM2020
High-order face-based discretization methods
with: Alexandre Ern and Simon Lemaire

2020: **Conference** Recontre JCJC ondes
online
with: Marcella Bonazzoli, Axel Modave and Bertrand Thierry

Editorial activities

Associate Editor for Examples & Counterexamples

Guest editor for Geosciences:
Special issue "Petroleum Engineering Applications: Borehole Simulations"

Reviewer for the journals:
Math. Comp.; SIAM J. Numer. Anal.; SIAM J. Sci. Comput.; Found. Comput. Math.;
ESAIM Math. Model. Numer. Anal.; IMA J. Numer. Anal.; Calcolo;
Comput. Geosci.; Geophys. J. Int.

Publications

[1] T. Chaumont-Frelet and A. Ern. *A priori and a posteriori analysis of the discontinuous Galerkin approximation of the time-harmonic Maxwell's equations under minimal regularity assumptions*. Math. Comp. (2025).
preprint: hal-04589791. doi: 10.1090/mcom/4091.

[2] T. Chaumont-Frelet and A. Ern. *Damped energy-norm a posteriori error estimates for fully discrete approximations of the wave equation using C2-reconstructions*. ESAIM Math. Model. Numer. Anal. **59** (2025), no. 4, 1937–1972.
preprint: hal-04511867. doi: 10.1051/m2an/2025027.

[3] S. Pescuma, G. Gabard, T. Chaumont-Frelet, and A. Modave. *A hybridizable Discontinuous Galerkin method with transmission variables for time-harmonic wave problems in heterogeneous media*. J. Comp. Phys. **534** (2025), 114009.
preprint: hal-04821539. doi: 10.1016/j.jcp.2025.114009.

[4] T. Chaumont-Frelet, J. Gedicke, and L. Mascotto. *Generalised gradients for virtual elements and applications to a posteriori error analysis*. Math. Comp. (2025).
preprint: hal-04668994. doi: 10.1090/mcom/4092.

[5] T. Chaumont-Frelet. *An equilibrated estimator for mixed finite element discretizations of the curl-curl problem*. IMA J. Numer. Anal. **45** (2025), no. 1, 329–353.
preprint: hal-04177080. doi: 10.1093/imanum/drae007.

[6] M. Bernkopf, T. Chaumont-Frelet, and J.M. Melenk. *Wavenumber-explicit stability and convergence analysis of hp finite element discretizations of Helmholtz problems in piecewise smooth media*. Math. Comp. **94** (2025), no. 351, 73–122.
preprint: hal-03771988. doi: 10.1090/mcom/3958.

[7] T. Chaumont-Frelet and M. Vohralík. *Constrained and unconstrained stable discrete minimizations for p-robust local reconstructions in vertex patches in the De Rham complex*. Found. Comput. Math. (2024).
preprint: hal-03749682. doi: 10.1090/mcom/4092.

[8] T. Chaumont-Frelet and M. Vohralík. *A stable local commuting projector and optimal hp approximation estimates in H(curl)*. Numer. Math. **156** (2024), no. 6, 2293–2342.
preprint: hal-03817302. doi: 10.1007/s00211-024-01431-w.

[9] T. Chaumont-Frelet, V. Dolean, and M. Ingremeau. *Efficient approximation of high-frequency Helmholtz solutions by Gaussian coherent states*. Numer. Math. **156** (2024), 1385–1426.
preprint: hal-03747290. doi: 10.1007/s00211-024-01411-0.

[10] T. Chaumont-Frelet. *Duality analysis of interior penalty discontinuous Galerkin methods under minimal regularity and application to the a priori and a posteriori error analysis of Helmholtz problems*. ESAIM Math. Model. Numer. Anal. **58** (2024), 1087–1106.
preprint: hal-03765207. doi: 10.1051/m2an/2024019.

[11] T. Chaumont-Frelet and P. Vega. *Frequency-explicit a posteriori error estimates for discontinuous Galerkin discretizations of Maxwell's equations*. SIAM J. Numer. Anal. **62** (2024), no. 1, 400–421.
preprint: hal-03744230. doi: 10.1137/22M1516348.

[12] T. Chaumont-Frelet. *Asymptotically constant-free and polynomial-degree-robust a posteriori estimates for space discretizations of the wave equation*. SIAM J. Sci. Comput. **45** (2023), no. 4, A1591–A1620.
preprint: hal-03632468. doi: 10.1137/22M1485619.

[13] T. Chaumont-Frelet and E.A. Spence. *Scattering by Finely Layered Obstacles: Frequency-Explicit Bounds and Homogenization*. SIAM J. Math. Anal. **55** (2023), no. 2, 1319–1363.
preprint: hal-03354770. doi: 10.1137/21M1450136.

[14] T. Chaumont-Frelet. *A simple equilibration procedure leading to polynomial-degree-robust a posteriori error estimators for the curl-curl problem*. Math. Comp. **92** (2023), no. 344, 2413–2437.
preprint: hal-03323859. doi: 10.1090/mcom/3817.

[15] T. Chaumont-Frelet and M. Vohralík. *p-robust equilibrated flux reconstruction in based on local minimizations: application to a posteriori analysis of the curl-curl problem*. SIAM J. Numer. Anal. **91** (2023), no. 4, 1783–1818.
preprint: hal-03227570. doi: 10.1137/21M141909X.

[16] A. Modave and T. Chaumont-Frelet. *A hybridizable discontinuous Galerkin method with characteristic variables for Helmholtz problems*. J. Comp. Phys. **193** (2023), 112459.
preprint: hal-03909368. doi: 10.1016/j.jcp.2023.112459.

[17] T. Chaumont-Frelet and S. Nicaise. *An analysis of high-frequency Helmholtz problems in domains with conical points and their finite element discretisation*. Comput. Meth. Appl. Math. **23** (2023), no. 4, 899–916.
preprint: hal-04001691. doi: 10.1515/cmam-2022-0126.

[18] T. Chaumont-Frelet, A. Moiola, and E.A. Spence. *Explicit bounds for the high-frequency time-harmonic Maxwell equations in heterogeneous media*. J. Math. Pures Appl. **179** (2023), 183–218.
preprint: hal-04001866. doi: 10.1016/j.matpur.2023.09.004.

[19] T. Chaumont-Frelet, A. Ern, and M. Vohralík. *Stable broken H(curl) polynomial extensions and p-robust a posteriori error estimates by broken patchwise equilibration for the curl–curl problem.*. Math. Comp. **91** (2022), 37–74.
preprint: hal-02736200. doi: 10.1007/s10092-021-00430-9.

[20] T. Chaumont-Frelet, M.J. Grote, S. Lanteri, and J.H. Tang. *A controllability method for Maxwell's equations*. SIAM J. Sci. Comput. **44** (2022), no. 6, A3700–A3727.
preprint: https://inria.hal.science/hal-03250886. doi: 10.1137/21M1424445.

[21] T. Chaumont-Frelet, A. Ern, S. Lemaire, and F. Valentin. *Bridging the multiscale hybrid-mixed and multiscale hybrid high-order methods*. ESAIM Math. Model. Numer. Anal. **56** (2022), no. 1, 261–285.
preprint: hal-02644173. doi: 10.1090/mcom/3673.

[22] T. Chaumont-Frelet and P. Vega. *Frequency-explicit a posteriori error estimates for finite element discretizations of Maxwell's equations*. SIAM J. Numer. Anal. **60** (2022), no. 4, 774–1798.
preprint: hal-02943386. doi: 10.1137/21M1421805.

[23] T. Chaumont-Frelet and P. Vega. *Frequency-explicit approximability estimates for time-harmonic Maxwell's equations*. Calcolo **59** (2022), no. 2, 22.
preprint: hal-03221188. doi: 10.1007/s10092-022-00464-7.

[24] T. Chaumont-Frelet, D. Gallistl, S. Nicaise, and J. Tomezyk. *Wavenumber explicit convergence analysis for finite element discretizations of time-harmonic wave propagation problems with perfectly matched layers author*. Comun. Math. Sci. **20** (2022), no. 1, 1–52.
preprint: hal-01887267. doi: 10.4310/CMS.2022.v20.n1.a1.

[25] T. Chaumont-Frelet, A. Ern, and M. Vohralík. *On the derivation of guaranteed and p-robust a posteriori error estimates for the Helmholtz equation*. Numer. Math. **148** (2021), 525–573.
preprint: hal-02202233. doi: 10.1007/s00211-021-01192-w.

[26] T. Chaumont-Frelet and B. Verfürth. *A generalized finite element method for problems with sign-changing coefficients*. ESAIM Math. Model. Numer. Anal. **55** (2021), no. 3, 939–967.
preprint: hal-02496832. doi: 10.1051/m2an/2021007.

[27] T. Chaumont-Frelet and M. Vohralík. *Equivalence of local-best and global-best approximations in H(curl)*. Calcolo **58** , 53.
preprint: hal-03235525. doi: 10.1007/s10092-021-00430-9.

[28] T. Chaumont-Frelet, S. Lanteri, and P. Vega. *A posteriori error estimates for finite element discretizations of time-hamonic Maxwell's equatiosn coupled with a non-local hydrodynamic Drude model*. Comput. Meth. Appl. Engrg. **385** (2021), 114002.
preprint: hal-03164225. doi: 10.1016/j.cma.2021.114002.

[29] T. Chaumont-Frelet and S. Nicaise. *Wavenumber explicit convergence analysis for finite element discretizations of general wave propagation problems*. IMA J. Numer. Anal. **40** (2020), 1503–1543.
preprint: hal-01685388. doi: 10.1093/imanum/drz020.

[30] T. Chaumont-Frelet and F. Valentin. *A multiscale hybrid-mixed method for the Helmholtz equation in heterogeneous domains*. SIAM J. Numer. Anal. **58** (2020), no. 2, 1096–1067.
preprint: hal-01698914. doi: 10.1137/19M1255616.

[31] T. Chaumont-Frelet, S. Nicaise, and J. Tomezyk. *Uniform a priori estimates for elliptic problems with impedance boundary conditions*. Comm. Pure Appl. Anal. **19** (2020), no. 5, 2445–2471.
preprint: hal-01887269. doi: 10.3934/cpaa.2020107.

[32] V. Darrigrand, D. Pardo, T. Chaumont-Frelet, I. Gomez-Revuelto, and L.E. Garcia-Castillo. *A painless automatic hp-adatptive strategy for elliptic probems*. Finite Elem. Anal. Des. **178** (2020), 103424.
preprint: hal-02071427. doi: 10.1016/j.finel.2020.103424.

[33] T. Chaumont-Frelet, A. Ern, and M. Vohralík. *Polynomial-degree-robust H(curl)-stability of discrete minimization in a tetrahedron*. C. R. Math. Acad. Sci. Paris **358** (2020), no. 9–10, 1101–1110.
preprint: hal-02631319. doi: 10.5802/crmath.133.

[34] T. Chaumont-Frelet. *Mixed finite element discretizations of acoustic Helmholtz problems with high wavenumbers.*. Calcolo **56** (2019), 49.
preprint: hal-02197891. doi: 10.1007/s10092-019-0346-z.

[35] T. Chaumont-Frelet, M. Shahriari, and D. Pardo. *Adjoint-based formulation for computing derivaties with respect to bed boundary positions in resistivity geophysics*. Comput. Geosci. **23** (2019), 583–594.
preprint: hal-01790697. doi: 10.1007/s10596-019-9808-2.

[36] T. Chaumont-Frelet, S. Nicaise, and D. Pardo. *Finite element approximation of electromagnetic fields using nonfitting meshes for Geophysics*. SIAM J. Numer. Anal. **56** (2018), no. 4, 2288–2321.
preprint: hal-01706452. doi: 10.1137/16m1105566.

[37] T. Chaumont-Frelet, D. Pardo, and Á. Rodríguez-Rozas. *Finite element simulations of logging-while-drilling and extra-deep azimuthal resistivity measurements using non-fitting grids*. Comput. Geosci. **22** (2018), 1161–1174.
preprint: hal-01706455. doi: 10.1007/s10596-018-9744-6.

[38] T. Chaumont-Frelet and S. Nicaise. *High-frequency behaviour of corner singularities in Helmholtz problems*. ESAIM Math. Model. Numer. Anal. **52** (2018), no. 5, 1803–2018.
preprint: hal-01706415. doi: 10.1051/m2an/2018031.

[39] H. Barucq, T. Chaumont-Frelet, and C. Gout. *Stability analysis of heterogeneous Helmholtz problems and finite element solution based on propagation media approximation*. Math. Comp. **86** (2017), no. 307, 2129–2157.
preprint: hal-01408934. doi: 10.1090/mcom/3165.

[40] T. Chaumont-Frelet. *On high order methods for the heterogeneous Helmholtz equation*. Comp. Math. Appl. **72** (2016), 2203–2225.
preprint: hal-01408943. doi: 10.1016/j.camwa.2016.08.026.

[41] H. Barucq, T. Chaumont-Frelet, J. Diaz, and V. Péron. *Upscaling for the Laplace problem using a discontinuous Galerkin method*. J. Comput. Appl. Math. **240** (2013), 192–203.
preprint: hal-00757098. doi: 10.1016/j.cam.2012.05.025.

Prepublications

[42] T. Chaumont-Frelet and M. Vohralík. *A quasi-interpolation operator yielding fully computable error bounds*.
preprint: hal-05164027.

[43] T. Chaumont-Frelet, J. Gedicke, and L. Mascotto. *A generalized Hessian-based error estimator for an IPDG formulation of the biharmonic problem in two dimensions*.
preprint: hal-05176686.

[44] T. Chaumont-Frelet. *A new family of a posteriori error estimates for non-conforming finite element methods leading to stabilization-free error bounds*.
preprint: hal-05135065.

[45] T. Chaumont-Frelet and P. Henning. *The pollution effect for the Ginzburg-Landau equation*.
preprint: hal-05104390.

[46] T. Chaumont-Frelet. *A ill-posed scattering problem saturating Weyl's law*.
preprint: hal-05116635.

[47] T. Chaumont-Frelet. *A posteriori error estimates for the finite element discretization of second-order PDEs set in unbounded domains*.
preprint: hal-05008795.

[48] A. Rappaport, T. Chaumont-Frelet, and A. Modave. *A hybridizable discontinuous Galerkin method with transmission variables for time-harmonic electromagnetic problems*.
preprint: hal-05016261.

[49] T. Chaumont-Frelet and G. Gantner. *Adaptive boundary element methods for regularized combined field integral equations*.
preprint: hal-04917182.

[50] T. Chaumont-Frelet, J. Galkowski, and E. Spence. *Sharp error bounds for edge-element discretisations of the high-frequency Maxwell equations.*
preprint: hal-04670302.

[51] T. Chaumont-Frelet and S. Nicaise. *Frequency-explicit stability estimates for time-harmonic elastodynamic problems in nearly incompressible materials.*
preprint: hal-04500252.

[52] T. Chaumont-Frelet. *Asymptotically constant-free and polynomial-degree-robust a posteriori error estimates for time-harmonic Maxwell's equations.*
preprint: hal-04478624.

[53] T. Chaumont-Frelet and E.A. Spence. *The geometric error is less than the pollution error when solving the high-frequency Helmholtz equation with high-order FEM on curved domains.*
preprint: hal-04483175.

[54] T. Chaumont-Frelet and A. Ern. *Asymptotic optimality of the edge finite element approximation of the time-harmonic Maxwell's equations.*
preprint: hal-04216433.

[55] T. Chaumont-Frelet and M. Ingremeau. *Decay of coefficients and approximation rates in Gabor Gaussian frames.*
preprint: hal-03817302.

[56] T. Chaumont-Frelet, D. Paredes, and F. Valentin. *Flux approximation on unfitted meshes and application to multiscale hybrid-mixed methods.*
preprint: hal-03834748.

[57] G. Nehmetallah, T. Chaumont-Frelet, S. Descombes, and S. Lanteri. *A postprocessing technique for a discontinuous Galerkin discretization of time-dependent Maxwell's equations.*
preprint: hal-02956882.