

Théophile Chaumont-Frelet

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theophile.chaumont@inria.fr

(+33) 6 48 10 80 60

47 boulevard Gambetta, 06000 Nice, 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 2018: **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 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

- 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

- 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, 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: [hal-03250886](#). doi: [10.1137/21M1424445](#).
- [2] 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. (2022).
preprint: [hal-04001691](#). doi: [10.1515/cmam-2022-0126](#).
- [3] 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](#).
- [4] T. Chaumont-Frelet and P. Vega. *Frequency-explicit approximability estimates for time-harmonic Maxwell's equations*. Calcolo **59** (2022), article number: 22.
preprint: [hal-03221188](#). doi: [10.1007/s10092-022-00464-7](#).
- [5] T. Chaumont-Frelet, A. Ern, and M. Vohralík. *Stable broken $H(\text{curl})$ 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-02644173](#). doi: [10.1090/mcom/3673](#).
- [6] 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*. Commun. Math. Sci. **20** (2022), no. 1, 1–52.
preprint: [hal-01887267](#). doi: [10.4310/CMS.2022.v20.n1.a1](#).
- [7] T. Chaumont-Frelet, S. Lanteri, and P. Vega. *A posteriori error estimates for finite element discretizations of time-harmonic Maxwell's equations 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](#).
- [8] T. Chaumont-Frelet and M. Vohralík. *Equivalence of local-best and global-best approximations in $H(\text{curl})$* . Calcolo **58** (2021).
preprint: [hal-02736200](#). doi: [10.1007/s10092-021-00430-9](#).
- [9] 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](#).
- [10] 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](#).
- [11] T. Chaumont-Frelet, A. Ern, and M. Vohralík. *Polynomial-degree-robust $H(\text{curl})$ -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](#).
- [12] V. Darrigrand, D. Pardo, T. Chaumont-Frelet, I. Gomez-Revuelto, and L.E. Garcia-Castillo. *A painless automatic hp-adaptive strategy for elliptic problems*. Finite Elem. Anal. Des. **178** (2020), 103424.
preprint: [hal-02071427](#). doi: [10.1016/j.finel.2020.103424](#).

- [13] 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, 1029–1067.
preprint: [hal-01698914](#). doi: [10.1137/19M1255616](#).
- [14] 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](#).
- [15] 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](#).
- [16] T. Chaumont-Frelet. *Mixed finite element discretizations of acoustic Helmholtz problems with high wavenumbers*. Calcolo **56** (2019), no. 49.
preprint: [hal-02197891](#). doi: [10.1007/s10092-019-0346-z](#).
- [17] T. Chaumont-Frelet, M. Shahriari, and D. Pardo. *Adjoint-based formulation for computing derivatives 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](#).
- [18] T. Chaumont-Frelet and S. Nicaise. *High-frequency behaviour of corner singularities in Helmholtz problems*. ESAIM Math. Model. Numer. Anal. **5** (2018), 1803–1845.
preprint: [hal-01706415](#). doi: [10.1051/m2an/2018031](#).
- [19] 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](#).
- [20] 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](#).
- [21] 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](#).
- [22] 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](#).
- [23] 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

- [24] T. Chaumont-Frelet, A. Moiola, and E. Spence. *Explicit bounds for the high-frequency time-harmonic Maxwell equations in heterogeneous media.*
preprint: [hal-04001866](#).
- [25] A. Modave and T. Chaumont-Frelet. *A hybridizable discontinuous Galerkin method with characteristic variables for Helmholtz problems.*
preprint: [hal-03909368](#).
- [26] T. Chaumont-Frelet, D. Paredes, and F. Valentin. *Flux approximation on unfitted meshes and application to multiscale hybrid-mixed methods.*
preprint: [hal-03834748](#).
- [27] 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.*
preprint: [hal-03771988](#).
- [28] 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.*
preprint: [hal-03765207](#).
- [29] T. Chaumont-Frelet, V. Dolean, and M. Ingremeau. *Efficient approximation of high-frequency Helmholtz solutions by Gaussian coherent states.*
preprint: [hal-03747290](#).
- [30] T. Chaumont-Frelet and M. Ingremeau. *Decay of coefficients and approximation rates in Gabor Gaussian frames.*
preprint: [hal-03746979](#).
- [31] T. Chaumont-Frelet and M. Vohralík. *A stable local commuting projector and optimal hp approximation estimates in $H(\text{curl})$.*
preprint: [hal-03817302](#).
- [32] 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.*
preprint: [hal-03749682](#).
- [33] T. Chaumont-Frelet and P. Vega. *Frequency-explicit a posteriori error estimates for discontinuous Galerkin discretizations of Maxwell's equations.*
preprint: [hal-03744230](#).
- [34] T. Chaumont-Frelet. *Asymptotically constant-free and polynomial-degree-robust a posteriori estimates for space discretizations of the wave equation.*
preprint: [hal-03632468](#).
- [35] T. Chaumont-Frelet and E. Spence. *Scattering by finely-layered obstacles: frequency-explicit bounds and homogenization.*
preprint: [hal-03354770](#).
- [36] T. Chaumont-Frelet. *A simple equilibration procedure leading to polynomial-degree-robust a posteriori error estimators for the curl-curl problem.*
preprint: [hal-03323859](#).

- [37] T. Chaumont-Frelet and M. Vohralík. *p-robust equilibrated flux reconstruction in $H(\text{curl})$ based on local minimizations. Application to a posteriori analysis of the curl-curl problem.*
preprint: [hal-03227570](#).
- [38] 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](#).