

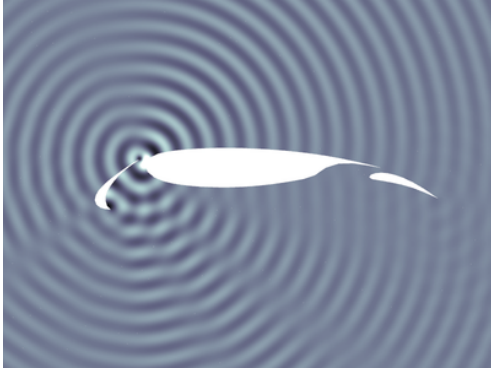
# Thomas Toulorge

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## RESEARCH INTERESTS

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My research field is **computational physics**. My activities are focused on the development and the analysis of **high-order numerical methods** for the solution of partial differential equations. The objective is to improve the efficiency of numerical simulations, and to extend the range of their applications. I am particularly interested in problems involving **complex geometries** which need to be solved with high accuracy, such as those encountered in **aeroacoustics** and in **fluid dynamics**. I have mainly worked on **discontinuous Galerkin** spatial discretizations, combined with **Runge-Kutta** time integration schemes. I am also interested in the generation of **curvilinear meshes**, that are necessary to fully benefit from the computational efficiency of high-order methods with curved geometries. In parallel, I take part in the development of techniques based on **anisotropic mesh**

**adaptation** and **level sets** for the representation of domain boundaries. These techniques aim to save the user from generating body-fitted meshes, which is a time-consuming and highly specialized task.

## EDUCATION

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- Feb. 2012 **Ph.D. in Engineering** — KU LEUVEN, Belgium  
Title: “Efficient Runge-Kutta Discontinuous Galerkin Methods Applied to Aeroacoustics”.  
Supervisor: Prof. Wim Desmet.
- Fall 2003 Double diploma, T.I.M.E. programme:  
**M.Sc. (Engineer’s degree)** — ÉCOLE CENTRALE DE LILLE, France  
**M.Sc. (Engineer’s degree)**, specialization in Aeronautics and Astronautics — KTH, Sweden
- Jul. 1997 **Scientific “Baccalauréat”**

## PROFESSIONAL EXPERIENCE AND RESEARCH

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- Since Oct. 2013 **Post-doctoral researcher** — FNRS & UCL, Belgium  
Research on mesh generation and adaptation, application to Fluid Dynamics. Redaction of European H2020 project proposals. Supervision of Ph.D. students. Teaching: exercise sessions.
- 2012 – 2013 **Post-doctoral researcher** — UCL, Belgium  
Research on mesh generation and adaptation, application to Fluid Dynamics. Participation in the European FP7 project “IDIHOM”. Supervision of Ph.D. students. Teaching: exercise sessions and lectures. Participation in a Ph.D. examination committee.
- 2007 – 2011 **Doctoral researcher** — KU LEUVEN, Belgium  
Marie-Curie grant of the European Commission in the framework of the RTN project “AETHER”. Research on high-order Runge-Kutta Discontinuous Galerkin methods, application to aeroacoustics. Teaching: tutoring.
- 2004 – 2007 **Engineer** — INTA, Spain  
R&D engineer in the field of Computational Fluid Dynamics. Development of Finite Volume and Lattice-Boltzmann codes. Participation in several projects at European (FP6, GARTEUR) and national level. In charge of a project funded by the aeronautical industry.

## ADDITIONAL INFORMATION

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### Languages:

French	Native language.
English	Fluent. Daily practice. TOEFL (ITP) test passed in 2001 with 617 points out of 677.
Spanish	Fluent. Resident in Spain for several years.
German	Good level, to be reactivated. ZMP degree from the Goethe Institut in 2000 with the grade “Good”.
Swedish	Good level, to be reactivated. Intensive courses. Resident in Sweden for one and a half years.
Dutch	Basic knowledge. Resident in Flanders for three years.

### Computer skills:

OS	UNIX/LINUX, Windows, MS-DOS.
Development	Languages: C++/C, FORTRAN, Python, Make, UNIX shell. Version control : SVN, Git. IDE's : Eclipse, Visual Studio.
Numerics	Libraries : BLAS, LAPACK. Parallelism : MPI, OpenMP. Scientific computing : NumPy, MATLAB/Octave, Maxima.
CFD	Solvers : OpenFOAM, Fluent. Meshing : Gmsh, Gambit.
Productivity	MS/Libre Office, LaTeX.

## REFERENCES

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## PUBLICATIONS & PRESENTATIONS

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In addition to publishing my own scientific results, I have been a reviewer for several articles submitted to the *Journal of Computational Physics*, the *SIAM Journal on Scientific Computing*, the *International Journal of Numerical Methods in Fluids* and *Engineering Fracture Mechanics*.

Most of my journal papers are available in PDF version at <http://perso.uclouvain.be/thomas.toulorge>.

### Peer-reviewed international journals:

1. M. Hornikx, W. De Roeck, **T. Toulorge**, and W. Desmet. Flow and geometrical effects on radiated noise from exhaust pipes computed by the fourier pseudospectral time-domain method. *Comput. Fluids*, 116:176–191, 2015
2. D.-L. Quan, **T. Toulorge**, G. Bricteux, J.-F. Remacle, and E. Marchandise. Anisotropic adaptive nearly body-fitted meshes for CFD. *Eng. Comput.*, 30(4):517–533, 2014
3. B. Seny, J. Lambrechts, **T. Toulorge**, V. Legat, and J.-F. Remacle. An efficient parallel implementation of explicit multirate Runge-Kutta schemes for discontinuous Galerkin computations. *J. Comput. Phys.*, 256(1):135–160, 2014
4. D.-L. Quan, **T. Toulorge**, E. Marchandise, J.-F. Remacle, and G. Bricteux. Anisotropic mesh adaptation with optimal convergence for finite elements using embedded geometries. *Comput. Method. Appl. Mech. Eng.*, 268:65–81, 2014
5. **T. Toulorge**, C. Geuzaine, J.-F. Remacle, and J. Lambrechts. Robust untangling of curvilinear meshes. *J. Comput. Phys.*, 254:8–26, 2013
6. **T. Toulorge** and W. Desmet. Optimal Runge-Kutta schemes for discontinuous Galerkin space discretizations applied to wave propagation problems. *J. Comput. Phys.*, 231(4):2067–2091, 2012
7. **T. Toulorge** and W. Desmet. CFL conditions for Runge-Kutta discontinuous Galerkin methods on triangular grids. *J. Comput. Phys.*, 230(12):4657–4678, 2011

8. **T. Toulorge** and W. Desmet. Curved boundary treatments for the discontinuous Galerkin method applied to aeroacoustic propagation. *AIAA J.*, 48:479–489, 2010
9. F. Moens, J. Perraud, A. Krumbein, **T. Toulorge**, P. Ianneli, and A. Hanifi. Transition prediction and impact on a three-dimensional high-lift-wing configuration. *J. Aircraft*, 45(5):1751–1766, 2008

#### Book chapters:

1. C. Geuzaine, A. Johnen, J. Lambrechts, J.-F. Remacle, and **T. Toulorge**. The generation of valid curvilinear meshes. In *IDIHOM: Industrialization of High-Order Methods - A Top-Down Approach*, volume 128 of *Notes on Numerical Fluid Mechanics and Multidisciplinary Design*. Springer International Publishing, 2015

#### Peer-reviewed proceedings of international conferences:

1. J.-F. Remacle, J. Lambrechts, C. Geuzaine, and **T. Toulorge**. Optimizing the geometrical accuracy of 2D curvilinear meshes. *Procedia Engineering*, 82:228–239, 2014. 23rd International Meshing Roundtable (IMR23), London, UK, 12–15 October 2014
2. J.-F. Remacle, **T. Toulorge**, and J. Lambrechts. Robust untangling of curvilinear meshes. In *Proceedings of the 21st International Meshing Roundtable*, pages 71–83. Springer Berlin Heidelberg, 2013. 21st International Meshing Roundtable (IMR21), San Jose, USA, 7–10 October 2012
3. **T. Toulorge** and W. Desmet. Spectral properties of discontinuous Galerkin space operators on curved meshes. In *Spectral and High Order Methods for Partial Differential Equations*, volume 76 of *Lecture Notes in Computational Science and Engineering*, pages 495–502. Springer Berlin Heidelberg, 2010. International Conference on Spectral and High-Order Methods (ICOSAHOM'09), Trondheim, Norway, 22–26 June 2010

#### International conferences:

1. **T. Toulorge**, J. Lambrechts, C. Geuzaine, and J.-F. Remacle. Geometrical accuracy and numerical properties of high-order meshes. International Conference on Adaptive Modeling and Simulation (ADMOS 2015), Nantes, France, 7–10 June 2015
2. **T. Toulorge**, J. Lambrechts, C. Geuzaine, and J.-F. Remacle. High-order mesh generation: Geometrical accuracy and numerical properties. European Conference on High Order Nonlinear Numerical Methods for Evolutionary PDEs: Theory and Applications (HONOM 2015), Trento, Italy, 16–20 March 2015
3. **T. Toulorge**, C. Geuzaine, A. Johnen, J. Lambrechts, and J.-F. Remacle. High-order mesh generation for CFD with aeronautical applications. 6th European Conference on Computational Fluid Dynamics (ECFD VI), Barcelona, Spain, 20–25 July 2014
4. **T. Toulorge**, A. Johnen, C. Geuzaine, J. Lambrechts, and J.-F. Remacle. High-order mesh generation for CFD. International Conference on Spectral and High-Order Methods (ICOSAHOM 2014), Salt Lake City, USA, 23–27 June 2014
5. J.-F. Remacle, J. Lambrechts, **T. Toulorge**, A. Johnen, and C. Geuzaine. Optimizing the geometrical accuracy of 2D curvilinear finite element meshes. 6th International Conference on Advanced Computational Methods in ENgineering (ACOMEN 2014), Gent, Belgium, 23–27 June 2014
6. J. Lambrechts, **T. Toulorge**, J.-F. Remacle, and V. Legat. Generation of provably correct curvilinear meshes. SIAM Conference on Mathematical & Computational Issues in the Geosciences, Padova, Italy, 17–20 June 2013
7. **T. Toulorge**, D.-L. Quan, E. Marchandise, and J.-F. Remacle. Anisotropic adaptive nearly body-fitted meshes for CFD. In *Proceedings of the International Conference on Adaptive Modeling and Simulation (ADMOS 2013)*, Lisbon, Portugal, 3–5 June 2013, 2013
8. H. Denayer, W. De Roeck, W. Desmet, and **T. Toulorge**. Acoustic characterization of a Helmholtz resonator under grazing flow conditions using a hybrid methodology. In *Proceedings of the 19th AIAA/CEAS Aeroacoustics Conference, Berlin, Germany, 27–29 May 2013*, 2013
9. J.-F. Remacle, A. Johnen, J. Lambrechts, **T. Toulorge**, T. Carrier-Baudouin, E. Marchandise, and C. Geuzaine. New mesh generation developments in GMSH. In *Actes du 11e Colloque National en Calcul des Structures (CSMA 2013)*, Giens, France, 13–17 May 2013, 2013
10. A. Johnen, J.-F. Remacle, **T. Toulorge**, J. Lambrechts, and C. Geuzaine. Computing bounds on the geometrical quality of 2d curvilinear finite elements. 9th International Symposium on Electric and Magnetic Fields (EMF 2013), Bruges, Belgium, 23–25 April 2013
11. **T. Toulorge**, C. Geuzaine, J.-F. Remacle, and J. Lambrechts. Generation of provably correct high-order meshes. Advances in Computational Mechanics (ACM 2013) – Finite Elements in Flow Problems (FEF 2013), San Diego, USA, 24–27 February 2013

12. D.-L. Quan, G. Briceux, E. Marchandise, J.-F. Remacle, and **T. Toulorge**. Anisotropic adaptive finite element meshes for incompressible flows. *Advances in Computational Mechanics (ACM 2013) – Finite Elements in Flow Problems (FEF 2013)*, San Diego, USA, 24–27 February 2013
13. J. Lambrechts, J.-F. Remacle, and **T. Toulorge**. Generation of provably correct curvilinear meshes. *Solution of Partial Differential Equations on the Sphere*, Isaac Newton Institute, Cambridge, UK, 24–28 September 2012
14. **T. Toulorge**, W. De Roeck, H. Denayer, and W. Desmet. Computational aeroacoustic characterization of different orifice geometries under grazing flow conditions. In *Proceedings of the International Conference on Noise and Vibration Engineering (ISMA 2012)*, Leuven, Belgium, 17–19 September 2012, 2012
15. G. Briceux, E. Marchandise, J.-F. Remacle, D.-L. Quan, and **T. Toulorge**. Alternative methods to represent embedded interfaces in a mesh. *Berlin PUM Workshop 2012*, Berlin, Germany, 22–24 August 2012
16. **T. Toulorge** and W. Desmet. Optimal Runge-Kutta schemes for discontinuous Galerkin spatial discretizations applied to wave propagation problems. *International Conference on Spectral and High-Order Methods (ICOSAHOM'12)*, Gammarth, Tunisia, 25–29 June 2012
17. **T. Toulorge** and W. Desmet. Time stepping and linear stability of Runge-Kutta discontinuous Galerkin methods on triangular grids. In J. C. F. Pereira and A. Sequeira, editors, *Proceedings of the Fifth European Conference on Computational Fluid Dynamics (ECCOMAS CFD 2010)*, Lisbon, Portugal, 14–17 June 2010, 2010
18. **T. Toulorge** and W. Desmet. Time stepping with Runge-Kutta discontinuous Galerkin methods on triangular grid. In *Proceedings of the 16th AIAA/CEAS Aeroacoustics Conference, Stockholm, Sweden, 7–9 June 2010*, 2010. AIAA Paper Nr. 2010–3986
19. W. De Roeck, **T. Toulorge**, and W. Desmet. A linear network representation for the determination of the acoustic properties of lined ducts carrying a non-uniform mean flow. In *Proceedings of the International Congress on Sound and Vibration (ICSV16)*, Krakow, Poland, 5–9 July 2009, 2009
20. **T. Toulorge** and W. Desmet. Curved boundary treatments for the discontinuous Galerkin method applied to aeroacoustic propagation. In *Proceedings of the 15th AIAA/CEAS Aeroacoustics Conference, Miami, USA, 11–13 May 2009*, 2009. AIAA Paper Nr. 2009–3176
21. **T. Toulorge**, Y. Reymen, and W. Desmet. A 2D discontinuous Galerkin method for aeroacoustics with curved boundary treatment. In *Proceedings of the International Conference on Noise and Vibration Engineering (ISMA 2008)*, Leuven, Belgium, 15–17 September 2008, 2008
22. F. Moens, J. Perraud, A. Krumbein, **T. Toulorge**, P. Ianneli, P. Eliasson, and A. Hanifi. Transition prediction and impact on 3D high-lift wing configuration. In *Proceedings of the 25th AIAA Applied Aerodynamics Conference, Miami, USA, 25–28 June 2007*, 2007. AIAA Paper Nr. 2007–4302
23. **T. Toulorge**, J. Ponsin, J. Perraud, and F. Moens. Automatic transition prediction for RANS computations applied to a generic high-lift wing. In *Proceedings of the 45th AIAA Aerospace Sciences Meeting and Exhibit, Reno, USA, 8–11 January 2007*, 2007. AIAA Paper Nr. 2007–1086

#### Seminars and invited lectures:

1. **T. Toulorge**, C. Geuzaine, A. Johnen, J. Lambrechts, and J.-F. Remacle. Generating valid, geometrically accurate and numerically appropriate curvilinear meshes. Seminar at Rice University – Dept. of Computational and Applied Mathematics, Houston (TX), USA, 10 April 2015
2. **T. Toulorge**, C. Geuzaine, A. Johnen, J. Lambrechts, and J.-F. Remacle. Curvilinear mesh generation: Validity, geometrical approximation and numerical properties. Seminar at INRIA, Bordeaux, France, 19 February 2015
3. **T. Toulorge**, C. Geuzaine, A. Johnen, J. Lambrechts, and J.-F. Remacle. High-order mesh generation: Validity, numerical properties and geometrical approximation. Seminar at INRIA, Sophia-Antipolis, France, 11 December 2014
4. **T. Toulorge**, C. Geuzaine, A. Johnen, J. Lambrechts, and J.-F. Remacle. High-order mesh generation: Validity, numerical properties and geometrical accuracy. Journées inter-groupes “Maillages” de la Société de Mathématiques Industrielles et Appliquées, Institut Henri Poincaré, Paris, France, 25 November 2014
5. **T. Toulorge** and J.-F. Remacle. Curved boundary grid generation for high order discretization methods and applications in aeronautics. VKI Lectures Series “Recent Developments in Higher Order Methods and Industrial Application in Aeronautics”, von Karman Institute, Rhode-St-Genèse, Belgium, 11 December 2013
6. **T. Toulorge**. High-order numerical methods for fluid dynamics and aeroacoustics. Seminar at École Centrale de Lyon – LMFA, France, 30 May 2013
7. **T. Toulorge**, C. Geuzaine, J. Lambrechts, and J.-F. Remacle. Curvilinear meshes in CFD. ERCOFTAC Seminar, Université catholique de Louvain, Belgium, 7 December 2012
8. **T. Toulorge** and L. Koloszar. Accurate numerical methods for aeroacoustic propagation. VKI Lectures Series “Advances in Aero-acoustics and Thermo-acoustics”, von Karman Institute, Rhode-St-Genèse, Belgium, 19 November 2010

9. **T. Toulorge.** The discontinuous Galerkin method: Numerical aspects and application to aeroacoustic propagation. Seminar at KU Leuven – Campus Kortrijk (KULAK), Belgium, 20 May 2010

**Theses:**

1. **T. Toulorge.** *Efficient Runge-Kutta Discontinuous Galerkin Methods Applied to Aeroacoustics*. PhD thesis, KU Leuven, Belgium, 2012. ISBN: 978-94-6018-479-6
2. **T. Toulorge.** Implementation of the dynamic mesh technique into a CFD code. Master's thesis, KTH, Stockholm, Sweden, 2003