

# Curriculum Vitae



Name: Thomas Takacs  
Academic titles: Priv.-Doz. Dipl.-Ing. Dr.  
bakk.techn.  
Date of birth: 29.09.1986  
Place of birth: Linz, Austria  
Nationality: Austrian

## Affiliation

Address: Johan Radon Institute for Computational and  
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## Academic Employment

02/2022 - 01/2023: *Research scientist*  
Johann Radon Institute for Computational and  
Applied Mathematics (RICAM)  
02/2016 - 01/2022: *University assistant (with PhD)*  
6 years limited contract  
Institute of Applied Geometry (JKU)  
03/2014 - 01/2016: *Research fellow*  
Dipartimento di Matematica (Università di Pavia)  
04/2011 - 02/2014: *University assistant (without PhD)*  
Institute of Applied Geometry (JKU)  
07/2010 - 03/2011: *Research scientist*  
Doctoral college 'Computational Mathematics' (JKU)  
funded by the FWF, W1214-N15, project DK3, and the  
Government of Upper Austria

## Habilitation

- 06/2021: Habilitation in *Mathematics* awarded (JKU)  
12/2020: Applied for habilitation at JKU  
Title of the thesis: *Smooth Geometries for Isogeometric Analysis*

## Education

- 07/2010 - 09/2013: Doctoral studies in *Technical Sciences* (JKU)  
Title of the thesis: *Regularity and Approximation Power of Isogeometric Discretizations for Parametrizations with Singularities*
- 01/2009 - 07/2010: Master's studies *Industrial Mathematics* (JKU)  
Title of the thesis: *Existence of Stiffness Matrix Integrals for Singularly Parameterized Domains in Isogeometric Analysis*
- 10/2005 - 01/2009: Bachelor's studies *Technical Mathematics* (JKU)  
09/1997 - 07/2005: BRG Ramsauerstraße Linz (Matura/A-Levels)

## Civil service

- 10/2005 - 09/2006: Civil Service in Linz, Austria

## Third Party Funding

Grant number: LIT project LIT-2019-8-SEE-116  
funded by the Government of Upper Austria

Duration: 12/2020 - 11/2022

Grants awarded: 108.631,00 EUR

Project title: *PARTITION - PDE aware isogeometric discretization based on neural networks*

Grant number: FWF stand-alone project P 30926-NBL  
funded by the Austrian Science Fund  
and the Government of Upper Austria

Duration: 12/2018 - 11/2021

Grants awarded: 136.791,39 EUR

Project title: *Weak and approximate  $C^1$ -smoothness in isogeometric analysis*

Grant number: WTZ SI 28/2018  
Scientific-technological cooperation  
with Slovenia, funded by the OeAD

Project partner: Marjeta Knez, Univerza v Ljubljani

Duration: 01/2018 - 12/2019

Grants awarded: 5.200,00 EUR

Project title: *Splines in Geometric Design and Numerical Analysis*

## Committee Work (JKU)

- 12/2016 - 01/2022: co-speaker of the Mittelbau Mathematik (mid-level staff)  
 10/2019 - 01/2022: member of the study committees  
 Mathematics and NaWi-Tec
- 12/2017 - 09/2019: member of the provisional study committee NaWi-Tec  
 10/2016 - 09/2019: member of the faculty council of the faculty of Engineering  
 & Natural Sciences (TNF)
- 10/2016 - 09/2019: deputy member of the study committees  
 Mathematics and doctoral studies in engineering and natural sciences
- 10/2007 - 09/2013: student member of the study committees  
 Mathematics and doctoral studies in engineering and natural sciences

## Outreach Activities (JKU)

### *Young Scientists Seminar* (2016/17)

supervision of workshops for high school students  
 on special topics in mathematics

### *Lange Nacht der Forschung* (2014, 2016)

Long Night of Science

modeling of geometric objects using straws (2014) and Lego (2016)

<http://www.langenachtderforschung.at>

<http://www.ag.jku.at/LangeNachtderForschung2014.htm>

<http://www.ag.jku.at/LangeNachtderForschung2016.htm>

### *Projektwoche Angewandte Mathematik* (2012)

Project Week Applied Mathematics

supervision of a research topic for high school students

### *FIT – Women in Engineering* (2011)

introductory lecture on mathematics for high school students

## Activities in the Scientific Community

- ▶ Program Co-Chair  
*International Conference on Geometric Modeling and Processing GMP 2022*
- ▶ Member of the Scientific Committee  
*SIAM Conference on Geometric Design* (since 2021)
- ▶ Member of the Scientific Committee  
*Conference on Isogeometric Analysis* (since 2017)
  - ▷ Session on *Unstructured Spline Technologies*  
organized with Xiaodong Wei and Jessica Zhang  
*IGA 2019*, München, Germany, September 2019
  - ▷ Session on *Isogeometric Spaces over Unstructured Meshes*  
organized with Jörg Peters and Jessica Zhang  
*IGA 2017*, Pavia, Italy, September 2017
- ▶ Member of the Technical Program Committee  
*Conference on Geometric Modeling and Processing* (since 2017)
- ▶ Workshop on *Function Approximation*  
organized with Christian Irrgeher  
Linz, Austria, December 2016
- ▶ Minisymposium on *Isogeometric Analysis on Complex Geometries*  
organized with Giancarlo Sangalli  
*SIAM Conference on Geometric Design and Physical Modeling*  
Salt Lake City, Utah, USA, October 2015

## Editorial Activities

- ▶ Managing Guest Editor in Computer Aided Geometric Design  
Special Issue for the *Conference on Geometric Modeling and Processing GMP 2022*

## Reviewing Activities

- ▶ Advances in Computational Mathematics
- ▶ Computer Aided Geometric Design
- ▶ Computer-Aided Design
- ▶ Computers and Mathematics with Applications
- ▶ Computer Methods in Applied Mechanics and Engineering
- ▶ Numerische Mathematik
- ▶ Results in Applied Mathematics
- ▶ Conference on Geometric Modeling and Processing
- ▶ SIAM Conference on Geometric Design

## Summary of Teaching Activities

### at JKU Linz (2011-14, 2016-19)

- ▶ Lecture and Tutorials *Geometric Methods* (2+1 h/4,25 ECTS)  
master's studies Mechatronics (in German)
- ▶ Lecture *Descriptive Geometry* (2 h/0 ECTS/Ergänzungsprüfung)  
bachelor studies Mechatronics (in German)
- ▶ Special Lecture *AI in Geometry and Simulation* (2 h/3 ECTS)  
master's studies Mathematics & PhD studies (in English)
- ▶ Special Lecture *Subdivision - Curves and Surfaces* (2 h/3 ECTS)  
master's studies Mathematics & PhD studies (in English)
- ▶ Special Lecture *Geometric Modeling for Simulations* (2 h/3 ECTS)  
master's studies Mathematics & PhD studies (in English)
- ▶ Special Lecture *Isogeometric Analysis* (2 h/3 ECTS)  
master's studies Mathematics & PhD studies (in English)  
together with Stefan Takacs (RICAM)
- ▶ Seminars and Tutorials  
bachelor and master's studies Mathematics, master's studies Mechatronics,  
teaching studies & PhD studies (in German and English)

### at the Università di Pavia (2019)

- ▶ Lecture *Foundations of Computer-Aided Geometric Design* (3 ECTS)  
Pavia - Milano Bicocca - INdAM PhD program in mathematics  
(in English)

### at the University of Applied Sciences Upper Austria in Wels (2010/11)

- ▶ Tutorials *Mathematics I & II* (1+1 h/2+2 ECTS)  
bachelor studies "Produktdesign und technische Kommunikation" and  
"Innovations- und Produktmanagement" (in German)

# Teaching Activities

at JKU Linz

W 2021/22	VO	<i>Darstellende Geometrie</i>
	VO	<i>Geometric Modeling for Simulations</i>
S 2021	VO+UE	<i>Geometrische Methoden</i>
W 2020/21	VO	<i>Darstellende Geometrie</i>
	VO	<i>Artificial Intelligence in Geometry and Simulation</i>
S 2020	VO+UE	<i>Geometrische Methoden</i>
W 2019/20	VO	<i>Darstellende Geometrie</i>
	VO	<i>Subdivision - Curves and Surfaces</i>
	SE	<i>Recent Results in Computer Aided Geometric Design and Isogeometric Analysis</i>
S 2019	VO+UE	<i>Geometrische Methoden</i>
W 2018/19	VO	<i>Darstellende Geometrie</i>
	VO	<i>Geometric Modeling for Simulations</i>
	UE	<i>Numerical Analysis of Isogeom. Methods</i>
S 2018	VO+UE	<i>Geometrische Methoden</i>
	UE	<i>Höhere Differentialgeometrie</i>
W 2017/18	VO	<i>Darstellende Geometrie</i>
	VO	<i>Subdivision - Curves and Surfaces</i>
S 2017	VO+UE	<i>Geometrische Methoden</i>
	SE	<i>JKU Young Scientists Seminar</i>
W 2016/17	VO	<i>Darstellende Geometrie</i>
	VO	<i>Isogeometric Analysis</i>
	SE	<i>JKU Young Scientists Seminar</i>
S 2016	VO+UE	<i>Geometrische Methoden</i>
	SE	<i>JKU Young Scientists Seminar</i>
W 2013/14	UE	<i>Differentialgeometrie</i>
	UE	<i>Einführung in die Geometrie</i>
	SE	<i>Algebraic Spline Curves and Surfaces</i>
S 2013	UE	<i>Computational Geometry</i>
	UE	<i>Geometrische Methoden</i>
W 2012/13	UE	<i>Differentialgeometrie</i>
	SE	<i>Algebraic Spline Curves and Surfaces</i>
S 2012	SE	<i>Isogeometric Analysis</i>
	SE	<i>Algebraic Spline Curves and Surfaces</i>
W 2011/12	UE	<i>Computational Geometry</i>
	UE	<i>Einführung in die Geometrie</i>
W 2009/10	Tutorium	<i>Mathematik IV – Numerik für Mechatronik</i>



**at the Università di Pavia**

S 2019      VO      *Foundations of Computer-Aided Geometric  
Design and Modeling*

**at the University of Appl. Sci. Upper Austria**

S 2011      UE      *Mathematik II*  
W 2010/11      UE      *Mathematik I*

VO	Vorlesung	Lecture
UE	Übung	Tutorials
SE	Seminar	Seminar

# List of Publications

## Publications in Journals (peer reviewed)

1. M. Kapl, G. Sangalli and T. Takacs. A family of  $C^1$  quadrilateral finite elements. *Advances in Computational Mathematics*, 47: 82, 2021.
2. P. Weinmüller and T. Takacs. Construction of approximate  $C^1$  bases for isogeometric analysis on two-patch domains. *Computer Methods in Applied Mechanics and Engineering*, 385: 114017, 2021.
3. S. Kargaran, B. Jüttler and T. Takacs. IGA using offset-based overlapping domain parameterizations. *Computer-Aided Design*, 139: 103087, 2021.
4. S. Sajavičius and T. Takacs. Imposing nonlocal boundary conditions in Galerkin-type methods based on non-interpolatory functions. *Computers & Mathematics with Applications*, 80(12): 2877–2895, 2020.
5. J. Grošelj, M. Kapl, M. Knez, T. Takacs and V. Vitrih. A super-smooth  $C^1$  spline space over planar mixed triangle and quadrilateral meshes. *Computers & Mathematics with Applications*, 80(12): 2623–2643, 2020.
6. M. Kapl, G. Sangalli and T. Takacs. Isogeometric analysis with  $C^1$  functions on planar, unstructured quadrilateral meshes. *The SMAI journal of computational mathematics*, Volume S5: p. 67-86, 2019.
7. S. Kargaran, B. Jüttler, S. K. Kleiss, A. Mantzaflaris and T. Takacs. Overlapping multi-patch structures in isogeometric analysis. *Computer Methods in Applied Mechanics and Engineering*, 356: 325–353, 2019.
8. M. Kapl, G. Sangalli and T. Takacs. An isogeometric  $C^1$  subspace on unstructured multi-patch planar domains. *Computer Aided Geometric Design*, 69: 55–75, 2019.
9. M. Kapl, G. Sangalli and T. Takacs. Construction of analysis-suitable  $G^1$  planar multi-patch parameterizations. *Computer-Aided Design*, 97: 41–55, 2018.
10. M. Kapl, G. Sangalli and T. Takacs. Dimension and basis construction for analysis-suitable  $G^1$  two-patch parameterizations. *Computer Aided Geometric Design*, 52: 75–89, 2017.
11. G. Dong, B. Jüttler, O. Scherzer and T. Takacs. Convergence of Tikhonov regularization for solving ill-posed operator equations with solutions defined on surfaces. *Inverse Problems and Imaging*, 11(2): 221–246, 2017.

12. A. Collin, G. Sangalli and T. Takacs. Analysis-suitable  $G^1$  geometry parametrizations for isogeometric analysis. *Computer Aided Geometric Design*, 47: 93–113, 2016.
13. G. Sangalli, T. Takacs and R. Vázquez. Unstructured spline spaces for isogeometric analysis based on spline manifolds. *Computer Aided Geometric Design*, 47: 61–82, 2016.
14. S. Takacs and T. Takacs. Approximation error estimates and inverse inequalities for B-splines of maximum smoothness. *Mathematical Models and Methods in Applied Sciences*, 26: 1411–1445, 2016.
15. T. Takacs, B. Jüttler and O. Scherzer. Derivatives of isogeometric functions on  $n$ -dimensional rational patches in  $\mathbb{R}^d$ . *Computer Aided Geometric Design*, 31(7-8): 567–581, 2014.
16. T. Takacs and B. Jüttler.  $H^2$  regularity properties of singular parameterizations in isogeometric analysis. *Graphical Models*, 74(6): 361–372, 2012.
17. T. Takacs and B. Jüttler. Existence of stiffness matrix integrals for singularly parameterized domains in isogeometric analysis. *Computer Methods in Applied Mechanics and Engineering*, 200(49-52): 3568–3582, 2011.

## Publications in Proceedings (peer reviewed)

18. Q. Zhang, T. Takacs and F. Cirak. Manifold-based B-splines on unstructured meshes. In: *Isogeometric Analysis and Applications 2018*, Springer, 217–235, 2021.
19. T. Takacs. Construction of smooth isogeometric function spaces on singularly parameterized domains. In J.-D. Boissonnat et al. (Eds.): *Curves and Surfaces 2014*, Springer, LNCS 9213, 433–451, 2015.
20. T. Takacs and B. Jüttler. Derivatives of isogeometric test functions. In: *Proc. Mathematics of Surfaces XIV*, IMA, pp 345–364 (on CD), 2013.

## Book Chapters & Proceedings (not peer reviewed)

21. T.J.R. Hughes, G. Sangalli, T. Takacs and D. Toshniwal. Smooth multi-patch discretizations in Isogeometric Analysis. In *Geometric Partial Differential Equations - Part II*, Handbook of Numerical Analysis, Volume 22, 467–543, 2021.
22. T. Takacs. Singularities in isogeometric analysis. In B.H.V. Topping, (Editor): *Proceedings of the Eighth International Conference on Engineering Computational Technology*, Civil-Comp Press, Stirlingshire, UK, Paper 45, 2012.

## Preprints (submitted)

23. P. Weinmüller and T. Takacs. An approximate  $C^1$  multi-patch space for isogeometric analysis with a comparison to Nitsche's method. arXiv:2202.04516, 2022.
24. T. Takacs and D. Toshniwal. Almost- $C^1$  splines: Biquadratic splines on unstructured quadrilateral meshes and their application to fourth order problems. arXiv:2201.11491, 2022.
25. C. L. Chan, F. Scholz and T. Takacs. Locally refined quad meshing for linear elasticity problems based on convolutional neural networks, 2021.
26. R. Maier, P. Morgenstern and T. Takacs. Adaptive refinement for unstructured T-splines with linear complexity. arxiv:2109.00448, 2021.

## Preprints (in preparation)

27. A. Farahat, B. Jüttler, M. Kapl and T. Takacs. Isogeometric analysis with  $C^1$ -smooth functions over multi-patch surfaces.
28. T. Takacs. Approximation properties of isogeometric function spaces on singularly parameterized domains. arXiv:1507.08095.

## Theses

29. T. Takacs. Smooth Geometries for Isogeometric Analysis, *Habilitation Thesis*, JKU Linz, 2020.
30. T. Takacs. Regularity and Approximation Power of Isogeometric Discretizations for Parametrizations with Singularities, *PhD Thesis*, JKU Linz, 2013.
31. T. Takacs. Existence of Stiffness Matrix Integrals for Singularly Parameterized Domains in Isogeometric Analysis, *Master's Thesis*, JKU Linz, 2010.

# Selected Talks

## Invited Talks at Conferences

- ▶ Title TBA. *SMART - Conference on Subdivision, Geometric and Algebraic Methods, Isogeometric Analysis and Refinability in Italy*, Rimini, Italien, September 2022.
- ▶ Smooth geometries for isogeometric analysis. *CGTA - Conference on Geometry: Theory and Applications*, Gozd Martuljek, Slowenien, September 2021.

## Invited Talks at Universities

- ▶ Multi-patch discretizations and their application to IGA.  
*University of Pavia, Italy, May 2019.*
- ▶  $C^1$ -smoothness on multi-patch domains in isogeometric analysis.  
*Universität Hannover, Germany, November 2018.*
- ▶ Analysis-suitable  $G^1$  multi-patch parametrizations for IGA.  
*University of Ljubljana, Slovenia, July 2018.*
- ▶ Analysis-suitable  $C^1$  isogeometric spaces.  
*Cambridge University, UK, March 2018.*
- ▶ Approximation with  $C^1$  isogeometric functions over multi-patch domains.  
*University of Pavia, Italy, September 2016.*
- ▶ Isogeometric function spaces over parameter domains of arbitrary shape.  
*Hefei University of Technology, China, August 2015.*
- ▶ Einführung in die Isogeometrische Analysis - Theorie und Anwendungen.  
*TU Dresden, Germany, June 2014.*
- ▶ Regularity and approximation analysis of isogeometric discretizations on singular parametrizations.  
*University of Pavia, Italy, November 2013.*

## Talks at Conferences (selection)

- ▶  $C^1$  isogeometric discretizations over multi-patch domains. *GAMM Annual Meeting*, virtual meeting, March 2021.
- ▶  $C^1$  splines over meshes composed of quadrilaterals and triangles. *VIGA 2020*, virtual meeting, August 2020.
- ▶ Multi-patch discretizations for isogeometric analysis. *Dagstuhl Seminar "Interactive Design and Simulation"*, Dagstuhl, Germany, December 2019.
- ▶ Theoretical properties of  $C^1$  multi-patch constructions. *IGA 2019*, Munich, Germany, September 2019.
- ▶  $C^1$  smooth multi-patch isogeometric spaces. *MFO workshop on Mathematical Foundations of Isogeometric Analysis*, Oberwolfach, Germany, July 2019.
- ▶  $C^1$  smooth multi-patch discretizations and their application to IGA. *CGTA 2019*, Innsbruck, Austria, June 2019.
- ▶ Overlapping multi-patch domains in IGA. *BIRS workshop on Isogeometric Splines: Theory and Applications*, Banff, Canada, February 2019.
- ▶  $C^1$ -smooth isogeometric spaces on multi-patch domains. *ESI Thematic Programme: Numerical Analysis of Complex PDE Models in the Sciences*, Vienna, Austria, July 2018.
- ▶ Analysis-suitable  $G^1$  multi-patch parametrizations for isogeometric analysis. *Curves and Surfaces*, Arcachon, France, June 2018.
- ▶  $G^1$  multi-patch parametrizations for isogeometric analysis. *BIRS CMO workshop on Geometry & Computation for Interactive Simulation*, Oaxaca, Mexico, September 2017.
- ▶ Analysis-suitable  $G^1$  multi-patch domains in IGA. *IGA 2017*, Pavia, Italy, September 2017.

## **Further Activities and Memberships**

- ▶ participation at the curriculum for young scientists at the JKU (2012)
- ▶ participation at the Austrian and International Mathematical Olympiad (2003-2005), bronze medal at the IMO 2005
- ▶ member of the Austrian Mathematical Society ÖMG

Linz, 17. February 2021

Thomas Takacs