# Prof. Dr. Patrizio Neff

*Curriculum Vitae*

## Personal data


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| Born | 17th September, 1968 in Mosbach/Baden, Germany |
| Current position | Full Professor (W3) |
| Contact | University of Duisburg-Essen<br>Faculty of Mathematics<br>Thea-Leymann-Str. 9<br>45127 Essen |
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## Education

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|---|---|
| 1975–1979 | **Basic primary school**, *Pestalozzi-Schule*, Groß-Umstadt. |
| 1979–1981 | **Primary school**, *Geiersbergschule*, Groß-Umstadt. |
| 1981–1985 | **Secondary modern school**, *Ernst-Reuter-Schule*, Groß-Umstadt, *O-level*. |
| 1985–1988 | **Grammar school**, *Alfred-Delp-Schule*, Dieburg, *university entrance diploma*. |
| 1988–1989 | **Military Service**, *Panzergrenadierbataillon 53*, Fritzlar, Hessen. |
| 1989–1992 | **Undergraduate studies**, *TH Darmstadt*, Darmstadt.<br>Intermediate Diploma Mathematics and Examination in History (for teaching) |
| 1992–1995 | **Graduate studies**, *TH Darmstadt*, Darmstadt. |
| 1992–1993 | **Study abroad**, *University of Sussex*, Brighton GB.<br>Erasmus Stipendium, Lectures with Prof. Edmunds, Prof.Elliott |
| since 1994 | **Collaborater in the working group 6, Prof. H.-D. Alber**, *TH Darmstadt*, Darmstadt.<br>"Partial Differential Equations and Applications" |
| Nov. 1995 | **Diploma in Mathematics**, *TH Darmstadt*, Darmstadt, *"Summa cum laude"*.<br>Subjects I + II: Functional Analysis + Philosophy |
| 1996–1997 | **Ph.D. studies**, *TU Darmstadt*, Darmstadt.<br>Hessian State grant |

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| Feb. 2000 | **Ph.D.**, *TU Darmstadt*, Darmstadt, *"Summa cum laude"*. |
| 8th July, 2004 | **Habilitation**, *TU Darmstadt*, Darmstadt. |

## Theses

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|---|---|
| Nov. 1995 | Diploma thesis |
| Title | *"A stationary vortex ring as weak solution of the Euler equations"* |
| Supervisor | Prof. H.-D. Alber |
| Feb. 2000 | Ph.D. thesis |
| Title | *"Mathematical Analysis of Multiplicative Viscoplasticity"* |
| Referees | Prof. H.-D. Alber, Prof. E. Meister |
| Jul. 2004 | Habilitation thesis |
| Title | *"Geometrically exact Cosserat theory for bulk behaviour and thin structures. Modelling and mathematical analysis"* |
| Referees | Profs. H.-D. Alber, M. Hieber, K. Hutter, S. Müller, P. Steinmann |

## Professional experience

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| 1997–1998 | **Collaborator in interdisciplinary Collaborative Research Center SFB 298**, *TU Darmstadt*, Darmstadt.<br>"Deformation and Failure" under direction of Prof. Kollmann. |
| 1998–2000 | **Lecturer Department of Mathematics**, *TU Darmstadt*, Darmstadt. |
| 2000–2001 | **Senior Lecturer Department of Mathematics**, *TU Darmstadt*. |
| 2001–2002 | **Visiting Associate Professor**, *California Institute of Technology*, Pasadena, USA, Aeronautics, Prof. Ortiz. |
| 2002–2004 | **Senior Lecturer Department of Mathematics**, *TU Darmstadt*. |
| since July 2004 | **Assistant Professor Department of Mathematics**, *TU Darmstadt*. |
| Oct. 2005 | **Substitute of Full Professor W3 of Nonlinear Analysis**, *University of Duisburg-Essen*. |
| 2006–2009 | **Senior Lecturer Department of Mathematics**, *TU Darmstadt*. |
| since 2009 | **Full Professor W3 and Chair of Nonlinear Analysis**, *University of Duisburg-Essen*, Essen. |
| 2010–2012 | **Dean of Studies**, *Faculty of Mathematics, University of Duisburg-Essen*. |
| 2011–2015 | **Initiator and speaker of the Mathematics Preliminary Course Program**, *University of Duisburg-Essen*, supported by the *Bund-Länder-Programm*. |
| since 2012 | **Member of faculty board**, *Faculty of Mathematics, University of Duisburg-Essen*. |
| 2014–2015 | **Collaborator on the creation of the OMB+ E-Learning Platform**, *Cooperation of 11 German universities*. |
| spring 2016 | **Visiting Professor**, *INSA*, Lyon. |
| spring 2017 | **Visiting Professor**, *INSA*, Lyon. |

## Teaching experience

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| 2003 | Introduction to Variational Methods (english). |
| 2005 | Elementare Partielle Differentialgleichungen. |
| 2005–2006 | Mathematische Modellierung und Differentialgleichungen. |
| 2006–2007 | Mathematik I für Biologen und Chemiker. |
| 2007 | Mathematik II für Chemiker und Biologen. |
| 2007 | Elementare Partielle Differentialgleichungen, *Darmstadt*. |
| 2007–2008 | Mathematik I für Biologen und Chemiker. |
| 2008 | Mathematik II für Chemiker und Biologen. |
| 2008–2009 | Analysis I für Mathematiker (english). |
| 2009 | Funktionalanalysis 1. |
| 2009–2010 | Analysis 1 für Mathematiker. |
| 2010 | Analysis 2 für Mathematiker. |
| 2010–2011 | Analysis 3 für Mathematiker. |
| 2011 | Funktionalanalysis 1. |
| 2011–2012 | Analysis 1 für Mathematiker. |
| 2012 | Analysis 2 für Mathematiker. |
| 2012–2013 | Analysis 3 für Mathematiker. |
| 2013 | Variationsrechnung und Sobolevräume. |
| 2013–2014 | Analysis 1 für Mathematiker. |
| 2014 | Analysis 2 für Mathematiker. |
| 2014–2015 | Analysis 3 für Mathematiker. |
| 2015 | Variationsrechnung und Sobolevräume. |
| 2015–2016 | Nichtlineare Elastizitätstheorie. |
| 2016 | Gewöhnliche Differentialgleichungen. |
| 2016–2017 | Charakteristikentheorie und PDE. |
| 2018 | Variationsrechnung und Sobolevräume. |
| 2018–2019 | Nichtlineare Elastizitätstheorie. |
| 2019 | Gewöhnliche Differentialgleichungen. |
| 2019–2021 | Analysis 1 für Mathematiker. |
| 2021 | Analysis 2 für Mathematiker. |
| 2021–2022 | Analysis 3 für Mathematiker. |
| 2022 | Gewöhnliche Differentialgleichungen. |
| 2022–2023 | Partielle Differentialgleichungen. |
| 2023 | Variationsrechnung und Sobolevräume. |
| 2023–2024 | Nichtlineare Elastizitätslehre. |

## Conferences and workshops

More than 150 talks and presentations, including the following:

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| October 2001 | **Seminar**, *Joint Mathematics and Mechanics Colloquium*, California Institute of Technology, Pasadena. |
| May 2002 | **Plenary lecture**, *Joint Mathematics and Mechanics Colloquium*, University of California, Berkeley. |
| April 2004 | **Seminar**, *Oberseminar Analysis*, Max-Planck Institut für Mathematik in den Wissenschaften. |
| January 2005 | **Plenary lecture**, *GAMM Seminar on Microstructures*, TU Darmstadt. |
| November 2005 | **Miniworkshop**, *Analysis and Computation of Microstructure in Finite Plasticity*, MFO, Oberwolfach. |
| October 2006 | **Seminar**, *COMMAS Summer School on "Computational Mechanics of Materials and Structures"*, Universität Stuttgart. |
| December 2006 | **Plenary lecture**, *Institute of Fundamental Technological Research*, Polish Academy of Sciences, Warsaw. |
| April 2007 | **Seminar**, *Instituts-Kolloquium*, Max-Planck Institut für Eisenforschung. |
| September 2007 | **Plenary lecture**, *Langenbach-Seminar*, Weierstraß Institut für Angewandte Analysis und Stochastik, Berlin. |
| September 2007 | **Plenary lecture**, *Advanced school on "Poly, quasi and rank one convexity in applied mechanics"*, Centre International des Sciences Mecanique (CISM), Udine. |
| November 2007 | **Seminar**, *Colloquium on Applied Analysis*, Universite Pierre et Marie Curie, Paris. |
| January 2008 | **Plenary lecture**, *IUTAM Symposium on Theoretical, Modelling and Computational Aspects of Inelastic Media*, Capetown. |
| February 2008 | **Seminar**, *Applied Mathematics Seminar*, Mathematical Institute, University of Oxford. |
| May 2008 | **Seminar**, *SISSA: International School for Advanced Science*, Trieste, Italy. |
| May 2009 | **Plenary lecture**, *Euromech-Conference 510: Mechanics of generalized continua*, Sorbonne, U-Paris 6, Paris. |
| October 2009 | **Plenary lecture**, $9^{th}$ *conference "Shell-Structures: Theory and Applications"*, Gdansk-Jurata. |
| November 2012 | **Plenary lecture**, *Kolloquium des Fachbereiches Mathematik*, TU Darmstadt. |
| July 2013 | **Plenary lecture**, *Canadian Conference of Nonlinear Solid Mechanics*, McGill-University, Montreal. |
| July 2013 | **Invited**, *ASME-Annual Summer Meeting: SES Medal Symposium in honor of D.J. Steigmann*, Brown University, Providence. |
| March 2014 | **Plenary lecture**, *Euromech on Generalized Continua*, Cisterna di Latina. |
| February 2015 | **Plenary lecture**, *International Symposium on Modern Mathematics and Mechanics*, Olomouc. |
| July 2015 | **Invited**, *European Solid Mechanics Congress*, Madrid. |
| October 2015 | **Keynote**, *International Conference on Extended Continuum Models*, Antalya. |
| November 2015 | **Miniworkshop**, *Plasticity on Different Scales*, MFO, Oberwolfach. |
| June 2016 | **Plenary lecture**, *ETAMM Conference - Emerging Trends in Applied Mathematics and Mechanics*, Perpignan. |

July 2016 **Plenary lecture**, *Conference in Honour of G. Grioli*, Accademia Nazionale del Lincei, Rome.

March 2017 **Invited**, *Minisymposium on dislocation-based plasticity*, GAMM annual meeting, Weimar.

June 2017 **Keynote**, *International Symposium on Defects and Material Mechanics*, Lyon.

February 2018 **Workshop**, *Variational Methods for the Modeling of Inelastic Solids*, MFO, Oberwolfach.

April 2018 **Workshop**, *Nonlinear Data: Theory and Algorithms*, MFO, Oberwolfach.

June 2018 **Plenary lecture**, *ETAMM Conference - Emerging Trends in Applied Mathematics and Mechanics*, Krakow.

September 2018 **Keynote**, *Mathematics of Thin Structures*, Dresden.

October 2018 **Workshop**, *Computational Engineering*, MFO, Oberwolfach.

December 2022 **Lecture**, *GAMM Nachwuchsgruppe*, Ruhr-Unviersität Bochum.

March 2023 **Lecture**, *Ph.D.-Seminar*, Università di Roma.

## Supervised Ph.D. theses

2006 **Daniel Balzani**, *Polyconvex anisotropic energies and modelling of damage applied to arterial walls*.
W3-Professor for Computational Engineering, Ruhr Universität Bochum

2007 **Ingo Münch**, *Ein geometrisch und materiell nichtlineares Cosserat-Modell. Theorie, Numerik und Anwendungsmöglichkeiten*.
W3 Professor Statistics and Dynamics, TU Dortmund

2008 **Joelle Beyrouthy**, *Reduction dimensionnelle d'un modele viscoelastique en grandes deformations*.

2009 **Wolfgang Müller**, *Newton-type algorithms on* SO(3) *and elasto-plastic Cosserat models*.

2010 **Stefanie Vanis**, *Numerical simulation of finite micromorphic elasticity using FETI-DP domain decomposition methods*.
W2-Professor at the Faculty of Automative Engineering, Ostfalia University of Applied Science Wolfsburg

2010 **Vera Vetrov née Ebbing**, *Design of polyconvex energy functions for all anisotropy classes*.
Full Professor, Institute of Engineering and Natural Science, Westfälische Hochschule, Gelsenkirchen

2016 **Robert Martin**, *Logarithmic strain and its role in nonlinear elasticity*.
Assistant Professor at the Faculty of Engineering, University of Duisburg-Essen

2016 **Christian Thiel**, *Neue Matrix-Ungleichungen und Anwendungen auf konstitutive Beziehungen in der nichtlinearen Elastizitätstheorie*.

2019 **Robert Martin**, *Generalized convexity of functions and relaxation in nonlinear elasticity theory*, Habilitation Thesis.

2021 **Jendrik Voss**, *Constitutive inequalities in nonlinear elasticity and quasiconvexity*.

2022 **Hassam Khan**, *Analytical solutions in the relaxed micromorphic model (DAAD grant)*.

2022 **Maryam Mohammadi Saem**, *Higher-order Γ-convergence for Cosserat shells*.

## Publications

More than 165 refereed articles with > 2233 citations by > 849 authors in MathSciNet, h-index (excluding self-citations): 35 (Scopus), see also

- zbMath
- Web of Science
- arXiv
- google scholar (> 7793 citations)
- Research Gate (> 8118 citations)

## Selected Publications


[1] P. Neff. "On Korn's first inequality with non-constant coefficients". *Proceedings of the Royal Society of Edinburgh Section A: Mathematics* 132.01 (2002). Pp. 221–243.

[2] J. Schröder and P. Neff. "Invariant formulation of hyperelastic transverse isotropy based on polyconvex free energy functions". *International Journal of Solids and Structures* 40.2 (2003). Pp. 401–445. DOI: 10.1016/S0020-7683(02)00458-4.

[3] J. Schröder, P. Neff, and V. Ebbing. "Anisotropic polyconvex energies on the basis of crystallographic motivated structural tensors". *Journal of the Mechanics and Physics of Solids* 56.12 (2008). Pp. 3486–3506. DOI: 10.1016/j.jmps.2008.08.008.

[4] S. Nesenenko and P. Neff. "Well-posedness for dislocation based gradient viscoplasticity I: Subdifferential case". *SIAM Journal on Mathematical Analysis* 44.3 (2012). Pp. 1694–1712.

[5] P. Neff, Y. Nakatsukasa, and A. Fischle. "A logarithmic minimization property of the unitary polar factor in the spectral and Frobenius norms". *SIAM Journal on Matrix Analysis and Applications* 35.3 (2014). Pp. 1132–1154. DOI: 10.1137/130909949.

[6] P. Neff, D. Pauly, and K.-J. Witsch. "Poincaré meets Korn via Maxwell: Extending Korn's first inequality to incompatible tensor fields". *Journal of Differential Equations* 258.4 (2015). Pp. 1267–1302.

[7] S. Bauer, P. Neff, D. Pauly, and G. Starke. "Dev-Div- and DevSym-DevCurl-inequalities for incompatible square tensor fields with mixed boundary conditions". *ESAIM: Control, Optimisation and Calculus of Variations* 22.1 (2016). Pp. 112–133.

[8] A. Madeo, P. Neff, I.-D. Ghiba, and G. Rosi. "Reflection and transmission of elastic waves at interfaces embedded in non-local band-gap metamaterials: a comprehensive study via the relaxed micromorphic model". *Journal of the Mechanics and Physics of Solids* 95 (2016). Pp. 441–479.

[9] P. Neff, B. Eidel, and R. J. Martin. "Geometry of logarithmic strain measures in solid mechanics". *Archive for Rational Mechanics and Analysis* 222.2 (2016). Pp. 507–572, available at arXiv:1505.02203. DOI: 10.1007/s00205-016-1007-x.

[10] I.-D. Ghiba, R. J. Martin, and P. Neff. "Rank-one convexity implies polyconvexity in isotropic planar incompressible elasticity". *Journal de Mathématiques Pures et Appliquées* 116 (2018). Pp. 88–104.


## Grants and Funding

*"Konstruktion und Analyse anisotroper polykonvexer Energiefunktionen"*
DFG Research Project **NE 902/2-1** and **SCHR 570/6-1**, with J. Schröder

First funding period: 2006–2008, Second funding period: 2009–2011
Funding received: $\sim$ 315.000 €

*MINT-Vorkurs*
Part of the *Bund-Länder-Programm*
One professorship (W2) and two assistant positions (TVL-E13)
Funding received: $\sim$ 900.000 €

"*Modelling and mathematical analysis of geometrically nonlinear elasto-plastic Cosserat shells with higher order effects*"
DFG research project **NE 902/8-1** and **BI 1965/2-1**, with M. Birsan
Funding period: 2019–2023
Funding: $\sim$ 175.000 €
Approved

"*A variational scale-dependent transition scheme - from Cauchy elasticity to the relaxed micromorphic continuum*"
DFG research project **NE 902/10-1** and with L. Scheunemann and J. Schröder.
Funding period: 2021–2024
Funding: $\sim$ 11.000 €
Approved

"*A variational scale-dependent transition scheme - from Cauchy elasticity to the relaxed micromorphic continuum*"
DFG research project **NE 902/10-2** and with L. Scheunemann and J. Schröder.
Funding period: 2023–2026
Funding: $\sim$ 24.000 €
Approved

## Member of Editorial Board

- Archive of Mechanics, Springer
- Zeitschrift für Angewandte Mathematik und Physik, Springer
- Mathematics and Mechanics of Solids, Sage
- Mathematics and Mechanics of Complex Systems, msp
- Journal of Elasticity, Springer
- Continuum Mechanics and Thermodynamics, Springer
- GAMM-Mitteilungen, Wiley
- Archive of Applied Mechanics, Springer

## Main research interests

Nonlinear partial differential equations, generalized Korn's inequalities, nonlinear elasticity theory, theory of shells, plates and membranes, elastoplasticity theory, extended continuum mechanics (Cosserat, miropolar, micromorph), homogenisation and Γ-convergence, matrix analysis