

# Curriculum Vitae

## PERSONAL INFORMATION

Kúkelová Zuzana

Date of birth: October 17<sup>th</sup> 1981

Nationality: Slovak

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## EDUCATION

- 2013 **PhD**, Faculty of Electrical Engineering, Czech Technical University in Prague, Czech Republic. Title: Algebraic Methods in Computer Vision, defended 21/10/2013, PhD Supervisor: Tomas Pajdla, Reviewers: Andrew Fitzgibbon (Microsoft Research Cambridge), Rekha R. Thomas (University of Washington), Fredrik Kahl (Lund University)
- 2005 **Doctor of Natural Science (RNDr.)**, Computer Graphics and Geometry, Comenius University, Bratislava, Slovakia
- 2005 **Master**, Computer Graphics and Geometry, Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia

## EMPLOYMENT

- 2020 – now **Assistant Professor**, FEE, Department of Cybernetics, CTU in Prague, Czech Republic, Research topics: Algebraic methods in Computer Vision, Camera geometry problems.
- 2016 – 2020 **Research Fellow**, FEE, Department of Cybernetics, CTU in Prague, Czech Republic, Research topics: Algebraic methods in Computer Vision, Camera geometry problems.
- 2014 – 2016 **Post-Doctoral Researcher**, Microsoft Research Cambridge, UK, Manager: Andrew Fitzgibbon (2x Marr Prize Winner)
- 2005 – 2014 **Research Assistant**, FEE, Department of Cybernetics, CTU in Prague, Czech Republic

## AWARDS AND DISTINCTIONS

- 2018 **Saburo Tsuji Best Paper Award** - The 14th Asian Conference on Computer Vision
- 2015 **The winner of the 2015 Cor Baayen Award** - an annual award given to a promising young researcher in computer science and applied mathematics by ERCIM – The European Research Consortium for Informatics and Mathematics.
- 2014 **Best Paper Honourable Mention** - The 12th Asian Conference on Computer Vision
- 2013 **The best PhD dissertation in cybernetics and informatics in Czech Republic** - The winner of CSKI (Czech Society for Cybernetics and Informatics) prize in 2013
- 2013 **Dean prize for prestigious PhD thesis**
- 2012 **Spotlight Paper** for the July 2012 issue of the IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)

## SELECTED INVITED TALKS AND LECTURES

- 06/2019 Techniques for Improving Speed and Stability of Minimal Solvers – Lecture at the CVPR 2019 tutorial – [The Art of Solving Minimal Problems](#), Long Beach, CA, USA
- 10/2018 Fast algebraic solvers for computer vision problems, Invited talk at [Real Algebraic Geometry and Optimization, ICERM Workshop](#), Providence, RI, USA
- 07/2018 Fast Gröbner basis solvers for computer vision problems, Invited talk at [Eastern European Computer Vision Conference \(EEVCV\)](#), Odesa, Ukraine
- 04/2018 Fast Gröbner basis solvers for computer vision problems – [Invited talk](#) at NII, Tokyo, Japan
- 03/2016 Algebraic Methods in Computer Vision, Invited talk at INRIA, Department of Computer Science at Ecole Normale Supérieure, France
- 12/2015 Tricks for fast and numerically stable solvers – Lecture at the ICCV 2015 tutorial – [The Art of Solving Minimal Problems](#), Santiago de Chile, Chile
- 10/2015 Algebraic Methods in Computer Vision – Invited talk at [European Research Consortium for Informatics and Mathematics \(ERCIM\) meeting](#), Vienna, Austria
- 06/2014 Algebraic Methods in Computer Vision – Invited talk at [Computational Nonlinear Algebra, ICERM Topical Workshop](#), Providence, RI, USA
- 04/2014 Algebraic Methods in Computer Vision – [Invited talk](#) at Microsoft Research Cambridge, UK

## SUPERVISION AND TEACHING

- **2 PhDs:** I co-supervise (50%) James Pritts on Rectification from coplanar repeats and I co-supervised (50%) Čeněk Albl on 3D reconstruction with time-variant geometry (defended in 2019).
- **More than 13 years of teaching experience** - Lectures and Labs at the Master and Bachelor degree level since 2006: Courses on Optimization; Processing of digital photography; Geometry of Computer Vision and Graphics; Advanced Robotics; 3D Computer vision; Theoretical basics of computer vision, graphics, and interaction; Math of continuous world; Intelligent Robotics; Computer Graphics. Places: Czech Technical University in Prague, and University of Ss. Cyril and Methodius in Trnava, Slovakia.

## ORGANISATION OF SCIENTIFIC MEETINGS

- 2019 **Co-organizer of the tutorial** – The Art of Solving Minimal Problems, Conference on Computer Vision and Pattern Recognition 2019 (**CVPR 2019**), Long Beach, USA
- 2018 **Co-chair** of 23rd Computer Vision Winter Workshop, **CVWW 2018**, Cesky Krumlov, Czech Republic
- 2015 **Co-organizer of the tutorial** – The Art of Solving Minimal Problems, International Conference on Computer Vision 2015 (**ICCV 2015**), Santiago de Chile, Chile
- 2014 **Co-chair** of 19th Computer Vision Winter Workshop, **CVWW 2014**, Křtiny, Czech Republic

## INSTITUTIONAL RESPONSIBILITIES

- 2013-2014 **Member of Academic senate AS FEL** – Faculty of Electrical Engineering, CTU in Prague
- 2007 **Member of Academic senate AS CVUT** – Czech Technical University in Prague

## PROFESSIONAL ACTIVITIES

- **Program chair** 3DV 2020 - International Conference on 3D Vision, Fukuoka, Japan – top international conference in the field of 3D computer vision
- **Area chair** ACCV 2020 - Asian Conference on Computer Vision, Kyoto, Japan  
3DV 2018 - International Conference on 3D Vision, Verona, Italy  
3DV 2019 - International Conference on 3D Vision, Quebec City, Canada
- **Program committees of major conferences** in my field (from 2008) – CVPR, ICCV, ECCV, ACCV, 3DV
- **Reviewer for top-tier journals** - IEEE Transactions on Pattern Analysis and Machine Intelligence (IEEE TPAMI, IF 17.73) and Journal of Mathematical Imaging and Vision (JMIV, IF 1.6)

## ACADEMIC COLLABORATION

- **National Institute of Informatics (NII), Tokyo, Japan:** I visited NII four times in 2017-2019, each time for 5 weeks. I am collaborating with Professor Akihiro Sugimoto and Associated Professor Yinqiang Zheng. Topics: Absolute pose solvers, Efficient solvers for rolling shutter cameras. This collaboration still continues and has led to joint publications in ICCV 2017, CVPR 2018, ACCV 2018
- **University of California, Berkeley, USA:** Collaboration with Professor Bernd Sturmfels (a well-known expert in algebraic geometry) and PhD student Joe Kileel. This collaboration has led to joint publications: CVPR 2017 and a journal publication in FoCM 2017
- **ETH Zurich, Switzerland:** I visited ETH Zurich in 2017 and 2018. Collaboration with Professor Marc Pollefeys, Postdoc researcher Viktor Larsson (still ongoing). This collaboration has led to a joint publication: ICCV 2019
- **University of Lund, Sweden:** Our collaboration started in 2008 and still continues. I am (was) working with – Professor Kalle Åström, Professor Magnus Oskarsson and PhD students M. Byröd, K. Josephson. This collaboration has led to joint publications: CVPR 2008, CVIU 2010, CVPR 2018
- **University of Oulu, Finland:** I visited University of Oulu in 2018 (1-month stay). Collaboration with Professor Janne Heikkilä and PhD student S. Bhayani. Topic: Sparse resultants for efficient solvers. Joint publication: CVPR 2020

## INDUSTRIAL COLLABORATION

- **Capturing reality**, Slovakia – Research consultant – Minimal problems in 3D reconstruction pipelines. The results of our research and our solvers are an important part of a 3D reconstruction software – **Reality Capture**<sup>1</sup>. This software is one of the most efficient software packages available and can reconstruct extremely precise 3D models from more than 100k images on a standard laptop within a few hours. Reality Capture was successfully used in many well-known cultural heritage projects (Cyark, Zamani Project,

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<sup>1</sup> <https://www.capturingreality.com/>

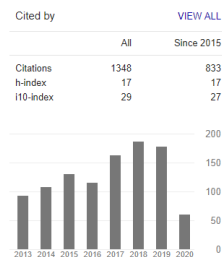
Factum Foundation)<sup>2</sup>, award-winning movies (Garden Party, Ghost in the Shell), award-winning VR/AR applications (ArtOfCorner), VFX, game industry, and many research and industrial projects.

## GRANTS AND FUNDINGS

- **Principal researcher in grants**
  - International Mobility of Researchers MSCA-IF in CTU, supported by EU, ESI Fund, OP RDE programme, reg. no. CZ.02.2.69/0.0/0.0/17\_050/0008025, 03/2018-02/2020.
  - SGS10/072/OHK4/1T/13 – Algebraic Methods in Computer Vision, Student grant competition 2010, Czech Technical University in Prague. 2010.
  - CTU grant No. CTU0806613 - Solving Systems of Polynomial Equations for Minimal Problems in Computer Vision, Czech Technical University in Prague. 2009.
- **Contributor to EC funded projects:** PRoViDE FP7-SPACE-2012-312377, De-Montes FP7-SME-2011-285839, PRoVisG FP7-SPACE-2007-218814, DIRAC FP6-IST-027787
- **Key researcher:** Research Center for Informatics, supported by EU, ESI Fund, OP RDE programme, reg. no. CZ.02.1.01/0.0/0.0/16\_019/0000765, 2018-2022.

## PUBLICATIONS

International journals	9
International conferences	35
International workshops	3
Total number of citations	1348
H-index	17
I10-index	29



## JOURNAL PUBLICATIONS

- PAMI 2020 J. Pritts, Z. Kukelova, V. Larsson, O. Chum., Y. Lochman, Minimal Solvers for Rectifying from Radially-Distorted Conjugate Translations, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, (IF 17.73), To appear.
- IJCV 2020 J. Pritts, Z. Kukelova, V. Larsson, O. Chum., Y. Lochman, Minimal Solvers for Rectifying from Radially-Distorted Scales and Change of Scales, *International Journal of Computer Vision*, 128, 950–968 (2020), (IF 6.071), Citations: 1.
- PAMI 2019 C. Albl, Z. Kukelova, V. Larsson, T. Pajdla, Rolling Shutter Camera Absolute Pose, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, (IF 17.73), To appear. Citations: 2
- OMS 2018 F. Šrajcar, Z. Kukelova, A Fitzgibbon. A Benchmark of Selected Algorithmic Differentiation Tools on Some Problems in Computer Vision and Machine Learning, *Optimization Methods and Software*, February 2018. (IF 1.183). Citations: 7
- FoCM 2017 J. Kileel, Z. Kukelova, T. Pajdla, B. Sturmfels. Distortion varieties. *Foundations of Computational Mathematics*, July 2017. (IF 2.829)
- PAMI 2012 Z. Kukelova, M. Bujnak, and T. Pajdla. Polynomial eigenvalue solutions to minimal problems in computer vision. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 34(7):1381–1393, 2012. (Spotlight paper, IF 4.795), Citations: 53
- CVA 2012 M. Bujnak, Z. Kukelova, and T. Pajdla. Efficient solutions to the absolute pose of cameras with unknown focal length and radial distortion by decomposition to planar and non-planar cases. *IPSJ Transaction on Computer vision and Application (CVA)*, 4:78–86, May 2012. Citations: 2
- PAMI 2011 Z. Kukelova and T. Pajdla. A minimal solution to radial distortion autocalibration. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 33(12):2410–2422, December 2011. (IF 4.908), Citations: 40
- CVIU 2010 Z. Kukelova, M. Byröd, K. Josephson, T. Pajdla, and K. Åström. Fast and robust numerical solutions to minimal problems for cameras with radial distortion. *Computer Vision and Image Understanding*, 114(2):234–244, February 2010. (IF 2.404), Citations: 34

<sup>2</sup> <https://www.capturingreality.com/Industry-UseCases>

## CONFERENCE PUBLICATIONS

- CVPR 2020 C. Albl, Z. Kukelova, V. Larsson, M. Polic, T. Pajdla, K. Schindler; From two rolling shutters to one global shutter, In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'20)*, 2020. (**Oral presentation**)
- CVPR 2020 S. Bhayani, Z. Kukelova, J. Heikkilä. A sparse resultant based method for efficient minimal solvers. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'20)*, 2020.
- CVPR 2020 M. Polic, S. Steidl, Z. Kukelova, C. Albl, T. Pajdla; Uncertainty Based Camera Model Selection In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'20)*, 2020.
- ICCV 2019 D. Baráth, Z. Kukelova. Homography From Two Orientation- and Scale-Covariant Features. In *IEEE International Conference on Computer Vision (ICCV'19)*, 2019.
- ICCV 2019 V. Larsson, T. Sattler, Z. Kukelova, M. Pollefeys. Revisiting Radial Distortion Absolute Pose. In *IEEE International Conference on Computer Vision (ICCV'19)*, 2019.
- CVPR 2019 Z. Kukelova, V. Larsson, Radial Distortion Triangulation. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'19)*, 2019. Citations: 1
- ACCV 2018 J. Pritts, Z. Kukelova, V. Larsson, O. Chum. Rectification from Radially-Distorted Scales, In *14th Asian Conference on Computer Vision (ACCV'18)*, Perth, Australia, 2018, (**Oral presentation, Best Paper Award**). Citations: 2
- ACCV 2018 Z. Kukelova, C. Albl, A. Sugimoto, T. Pajdla. Linear solution to the minimal absolute pose rolling shutter problem, In *14th Asian Conference on Computer Vision (ACCV'18)*, Perth, Australia, 2018. Citations: 2
- CVPR 2018 V. Larsson, Z. Kukelova, Y. Zheng, Camera Pose Estimation with Unknown Principal Point. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'18)*, 2018. Citations: 4
- CVPR 2018 V. Larsson, M. Oskarsson, K. Åström, A. Wallis, Z. Kukelova, T. Pajdla Beyond Gröbner Bases: Basis Selection for Minimal Solvers. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'18)*, 2018. Citations: 11
- CVPR 2018 J. Pritts, Z. Kukelova, V. Larsson, O. Chum. Radially-Distorted Conjugate Translations. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'18)*, 2018. Citations: 13
- ICCV 2017 V. Larsson, Z. Kukelova, Y. Zheng, Making Minimal Solvers for Absolute Pose Estimation Compact and Robust, In *IEEE International Conference on Computer Vision (ICCV'17)*. 2017. Citations: 11
- CVPR 2017 Z. Kukelova, J. Kileel, T. Pajdla, B. Sturmfels. A Clever Elimination Strategy for Efficient Minimal Solvers. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'17)*, 2017 (Acceptance rate 29%). Citations: 8
- CVPR 2017 C. Albl, Z. Kukelova, A. Fitzgibbon, J. Heller, M. Smid, T. Pajdla. On the Two-View Geometry of Unsynchronized Cameras. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'17)*, 2017 (Acceptance rate 29%). Citations: 11
- CVPR 2016 Z. Kukelova, J. Heller, A. Fitzgibbon. Efficient Intersection of Three Quadrics and Applications in Computer Vision. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'16)*, 2016 (Acceptance rate 29.9%), Citations: 14
- CVPR 2016 C. Albl, Z. Kukelova, T. Pajdla. Rolling Shutter Absolute Pose Problem With Known Vertical Direction. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'16)*, 2016 (Acceptance rate 29.9%). Citations: 15
- AD 2016 F. Srajer, Z. Kukelova, A. Fitzgibbon. A Benchmark of Selected Algorithmic Differentiation Tools on Some Problems in Machine Learning and Computer Vision. *7th International Conference on Algorithmic Differentiation (AD 2016)*, Oxford, 2016. Citations: 6
- ICCV 2015 Z. Kukelova, J. Heller, M. Bujnak, A. Fitzgibbon, T. Pajdla. Efficient Solution to the Relative Pose Problem for Radially Distorted Cameras. , In *IEEE International Conference on Computer Vision (ICCV'15)*. 2015. (Acceptance rate 30.92%). Citations: 16
- CVPR 2015 C. Albl, Z. Kukelova, T. Pajdla. R6P - Rolling Shutter Absolute Camera Pose. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'15)*, 2015 (**Oral Presentation, Acceptance rate 3.3%**), Citations: 42
- CVPR 2015 Z. Kukelova, J. Heller, M. Bujnak, T. Pajdla. Radial Distortion Homography In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'15)*, 2015. (Acceptance rate 28%). Citations: 34

- ACCV 2014 Z. Kukelova, M. Bujnak, J. Heller, T. Pajdla. Singly-Bordered Block-Diagonal Form for Minimal Problem Solvers. In *12th Asian Conference on Computer Vision (ACCV'14)*, Singapore, 2014, (**Oral presentation, Acceptance rate 3.9%, Best Paper Honourable Mention**), Citations: 11
- ICCV 2013 Z. Kukelova, M. Bujnak, T. Pajdla, Real-time solution to the absolute pose problem with unknown radial distortion and focal length, In *IEEE International Conference on Computer Vision (ICCV'13)*, Sydney, Australia, 2013. (Acceptance rate 27.9%), Citations: 17. Citations: 58
- AMOS 2013 Z. Kukelova, P. Krsek, V. Smutny and T. Pajdla Groebner basis solutions to satellite trajectory control by pole placement. In *Proceedings of the Advanced Maui Optical and Space Surveillance Technologies Conference (AMOS'13)*, 2013. Citations: 1
- 3DV 2013 Z. Kukelova, M. Bujnak, and T. Pajdla. Fast and stable algebraic solution to L2 three-view triangulation, In *International conference on 3d vision (3DV'13)*, Seattle, USA, June, 2013. Citations: 10
- ACCV 2012 Z. Kukelova, J. Heller and T. Pajdla. Hand-Eye Calibration without Hand Orientation Measurement Using Minimal Solution. In *11th Asian Conference on Computer Vision (ACCV'12)*, 2012 (Acceptance rate 26.6%), Citations: 13
- CVPR 2012 M. Bujnak, Z. Kukelova, and T. Pajdla. Making Minimal Solvers Fast. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'12)*, 2012. (Acceptance rate 24.1%), Citations: 31
- ACCV 2010 M. Bujnak, Z. Kukelova, and T. Pajdla. New efficient solution to the absolute pose problem for camera with unknown focal length and radial distortion. In *10th Asian Conference on Computer Vision (ACCV'10)*, volume 6492 of *Lecture Notes in Computer Science*, pages 11–24, 2011. (**Oral Presentation, Acceptance rate 4.7%**), Citations: 70
- ACCV 2010 Z. Kukelova, M. Bujnak, and T. Pajdla. Closed-form solutions to minimal absolute pose problems with known vertical direction. In *10th Asian Conference on Computer Vision (ACCV'10)*, volume 6493 of *Lecture Notes in Computer Science*, pages 216–229, 2011. (Acceptance rate 29.1%), Citations: 72
- CVVT 2010 A. Torii, Z. Kukelova, M. Bujnak, and T. Pajdla. The six point algorithm revisited. In *10th Asian Conference on Computer Vision (ACCV'10 Workshop, CVVT:E2M)*, volume 6469 of *Lecture Notes in Computer Science*, pages 184–193, 2011, Citations: 8
- ICCV 2009 M. Bujnak, Z. Kukelova, and T. Pajdla. 3D reconstruction from image collections with a single known focal length. In *IEEE International Conference on Computer Vision (ICCV'09)*, pages 1803–1810, 2009. (Acceptance rate 23.2%), Citations: 42
- ACCV 2009 M. Bujnak, Z. Kukelova, and T. Pajdla. Robust focal length estimation by voting in multi-view scene reconstruction. In *9th Asian Conference on Computer Vision (ACCV'09)*, pages 13–24, 2009. (**Oral Presentation, Acceptance rate 5.2%**), Citations: 13
- ECCV 2008 Z. Kukelova, M. Bujnak, and T. Pajdla. Automatic Generator of Minimal Problem Solvers. In *10th European Conference on Computer Vision (ECCV'08)*, volume 5304 of *Lecture Notes in Computer Science*, pages 302–315, 2008. (Acceptance rate 27.9%), Citations: 179
- CVPR 2008 M. Byröd, Z. Kukelova, K. Josephson, T. Pajdla, and K. Åström. Fast and robust numerical solutions to minimal problems for cameras with radial distortion. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'08), Vols 1-12*, pages 234–244, 2008. (**Oral presentation, acceptance ratio 4.0%**), Citations: 53
- CVPR 2008 M. Bujnak, Z. Kukelova, and T. Pajdla. A general solution to the p4p problem for camera with unknown focal length. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'08)*, pages 3506–3513, 2008. (Acceptance rate 31.8%), Citations: 149
- BMVC 2008 Z. Kukelova, M. Bujnak, and T. Pajdla. Polynomial eigenvalue solutions to the 5-pt and 6-pt relative pose problems. In *British Machine Vision Conference (BMVC'08)*, 2008, (**Oral presentation, acceptance ratio 12.5%**), Citations: 82
- OMNIVIS 2007 Z. Kukelova and T. Pajdla. Two minimal problems for cameras with radial distortion. In *7th Workshop on Omnidirectional Vision, Camera Networks and Non-classical Cameras (OMNIVIS'07)*, 2007. Citations: 33
- CVPR 2007 Z. Kukelova and T. Pajdla. A minimal solution to the autocalibration of radial distortion. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR'07)*, 2007. (Acceptance rate 28.2%), Citations: 77
- CVWW 2007 Z. Kukelova and T. Pajdla. Solving polynomial equations for minimal problems in computer vision. In *Computer Vision Winter Workshop (CVWW'07)*, Graz, Austria, 2007.

