THE UNIVERSITY of EDINBURGH
informatics

Informatics Forum
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Dr. Michel Steuwer

Professional Experience

since July 2020 **Lecturer (Assistant professor) in Compilers and Runtime Systems**, *University of Edinburgh*, UK.

2017–2020 **Lecturer (Assistant professor)**, *University of Glasgow*, UK.

2014–2017 **Postdoctoral Research Associate**, *The University of Edinburgh*, UK.

2010–2014 **Research Associate**, *University of Münster*, Germany.

University Education

2010–2015 **PhD degree in computer science**, *University of Münster*, Germany.
Supervisor: Prof. Sergei Gorlatch

2005–2010 **Diploma degree in computer science with a minor in mathematics**,
(equivalent to a combined MSc and BSc degree) University of Münster, Germany.

Honours and Achievements

- Recognition of our ICFP 2020 paper as a **Commun. of the ACM Research Highlight**
- Our ICFP 2020 paper selected as a **ACM SIGPLAN Research Highlight** in September 2021
- **Best Paper Award Winner** at ACM **CGO 2018**.
- **HiPEAC Paper Award Winner** for our papers at **ASPLOS 2018** and **ICFP 2020**.
- **Most cited papers** at **ICFP 2015**, **CGO 2017**, and **2018**.
- **PhD thesis** honoured with the highest possible grade **Summa cum laude**
  Nominated as one of 34 candidates for the **prize for best dissertation** completed in 2015 in Informatics at a German, Austrian, or Swiss University.

Research Projects and Grants

- Co-Investigator on the **EPSRC funded project** *Efficient Cross-Domain DSL Development for Exascale* (EP/W007940/1), £1M, August 2021 - August 2024. Together with Tobias Grosser (PI), Nick Brown, Amy Krause at Edinburgh and Gerard Gorman and Paul Kelly at Imperial.
- **Huawei-Edinburgh joint lab Project**, *A Safe Heterogeneous Systems Programming Language*, £150K, January 2022 – December 2023.
- **Google Faculty Award 2019**, *A functional Intermediate Representation for MLIR*, $50K, sponsored by Jacques Pienaar and Albert Cohen.
- Collaborator on a project funded as part of the **Software Defined Hardware (SDH) programme by DARPA**s. Together with Michael O'Boyle and Murray Cole at Edinburgh and collaborators at University of Michigan, Arizona State in the US, and McGill in Canada.

Research Community Activities

Program Committees, Artifact Evaluation Committees & Reviewing

- **Program Committee Member** of ACM CGO 2022, 2020, 2019, ACM CC 2020, ACM GPCE 2020, 2019, ACM LCTES 2019, 2018, ICPP 2020, FHPNC 2021, 2020, HLPP 2020, 2019, 2018, 2017, 2016, OMASE Workshop 2019, DHPCC++ Workshop 2019, 2018, and IEEE ScalCom 2016.
- **Artifact Evaluation Committees** of ACM ICFP 2017, ACM CGO 2017, and ACM PACT 2016.
- **External reviewer for journals**: Communications of the ACM, ACM TODS, ACM TACO, ACM Computing Surveys, Science of Computer Programming Journal (Elsevier), The Journal of Supercomputing (Springer), and Software: Practice and Experience (Wiley).
- **External reviewer for conferences**: CC, CGO, Euro-Par, EuroMPI, CCGrid, and ParCo.
- **Reviewer for funding bodies**: UK Engineering and Physical Sciences Research Council (EPSRC), Netherlands Organisation for Scientific Research, Natural Sciences and Engineering Research Council Canada, and Geman Federal Ministry of Education and Research (BMBF).

Organisation Committees

- **Steering Committee Member** of CGO since 2021
- **Artifact Evaluation Chair** of CGO 2021, 2020, 2019, 2018, CC 2021, 2020, and LCTES 2019, 2018.
- **Local Organisation Co-Chair** of HiPEAC Computer Systems Week in April 2019, Scottish Programming Language Seminar in March 2018, October 2019, and UK Many-Core Developer Conference UKMAC in May 2016.
- **Web Chair** of EuroPar 2022, and CC 2018.

Memberships in Research Networks

- Member of ACM, the German Informatics Society (GI: Gesellschaft für Informatik), the UK Many-core Research, Innovation and Opportunities Network (MaRIONet), the European Network on High Performance and Embedded Architecture and Compilation (HiPEAC) (Academic Member), the Institute for Computer Systems Architecture (ICSA) at the University of Edinburgh, the Compiler and Architecture Design (CArD) Group at the University of Edinburgh, and regular participant of the Scottish Programming Language Seminars (SPLS).

Local University Activities

- I am the undergraduate year 1 organiser coordinating the first year teaching of about 400 students at the School of Informatics in Edinburgh.
- I was the research student committee convener of the School of Computing Science at the University of Glasgow (2019-20). Overseeing the academic progression of over 100 PhD students.
- I organised Upwards, a seminar series in Glasgow discussing all aspects of research life to facilitate knowledge sharing among academics and providing career advices.
- I co-organised the Programming Language Research Programme at the School of Informatics in Edinburgh together with James Cheney, including a seminar series covering a broad range of topics related to programming languages.
- I organised the Humble C++ Programmer Group, a group discussing practical programming topics in C++ targeted at PhD students to improve their coding skills.

Supervised PhD Students

Currently Active PhD Students

since 09/2020 Xueying Qin at the University of Edinburgh — **Main Supervisor**

since 10/2019 Rongxiao Fu at the University of Glasgow — **Main Supervisor**, second supervisor Ornela Dardha

since 10/2019 Johannes Lenfers at the University of Münster — **Main Supervisor** together with Sergei Gorlatch

since 09/2019 Martin Lücke at the University of Edinburgh — **Main Supervisor** together with Aaron Smith

since 11/2018 Thomas Koehler at the University of Glasgow — **Main Supervisor**, second supervisor Phil Trinder

since 10/2018 Bastian Köpcke at the University of Münster — **Main Supervisor** together with Sergei Gorlatch

since 09/2016 Federico Pizzuti at the University of Edinburgh — Second Supervisor together with Christophe Dubach

Graduated PhD Students

2015 - 2021 Larisa Stoltzfus at the University of Edinburgh — Second Supervisor together with Christophe Dubach
Now Applications Consultant at EPCC

2016 - 2020 Bastian Hagedorn at the University of Münster — **Main Supervisor** together with Sergei Gorlatch
Only european receipient of the NVIDIA Graduate Fellowship 2019 worth 50K$.
Selected as participant of the Heidelberg Laureate Forum 2019.
Now Research Engineer at Nvidia

2014 - 2019 Toomas Remmelg at the University of Edinburgh — Second Supervisor together with Christophe Dubach
Winner of the Estonian *national contest for university students* awarded for his doctoral thesis
Now Senior Graphics Software Engineer at ARM

2015 - 2018 Michael Haidl at the University of Münster — Second Supervisor together with Sergei Gorlatch
Now Senior Compiler Engineer at NVIDIA

2013 - 2017 Juan José Fumero at the University of Edinburgh — Second Supervisor together with Christophe Dubach
Now Postdoctoral Research Associate at the University of Manchester

PhD Examination Committee

Internal Examiner

09/2018 Blair Archibald, University of Glasgow

External Examiner

08/2020 Bastian Hagedorn, University of Münster, Germany

09/2019 Sebastian Ertel, Technical University of Dresden, Germany

Research Visits

- Visiting researcher at dividiti Ltd. in Cambridge, UK 2016 (3 month, funded by HiPEAC).
- Visiting researcher at the University of Edinburgh, Scotland, UK 2012 (3 month, funded by HPC-Europa2), 2013 (4 month, funded by HiPEAC), and 2014 (4 month).
- Hosting visiting researchers from the University of Münster, Germany 2016 (2 month, funded by EuroLab-4-HPC), 2017 (4 month, funded by EuroLab-4-HPC), 2018 (4 month, funded by HPC-Europa3), 2019 (4 month, funded by HPC-Europa3 and EuroLab-4-HPC), and 2020 (3 month, funded by EuroLab-4-HPC).

Publications

In my research communities publications in highly regarded conferences are much higher valued than journal publications. I list – where known to me – the acceptance rate of the conferences.

Publication Statistics

So far I have published **56 peer reviewed papers**: 8 Journal Articles, 18 Conference Papers, 23 Workshop Papers, 4 Technical Reports, and 3 Book Chapters.

Citation Statistics

Overall citations: 1000, **h-index: 17**, **i-index: 20** (from Google Scholar 1st October 2021)

Journal Articles

2021 [J1] A. Rasch, R. Schulze, **M. Steuwer**, and S. Gorlatch. "Efficient Auto-Tuning of Parallel Programs with Interdependent Tuning Parameters via Auto-Tuning Framework (ATF)". In: *ACM TACO* 18.1 (2021), 1:1–1:26.

2020 [J2] B. Hagedorn, J. Lenfers, T. Koehler, X. Qin, S. Gorlatch, and **M. Steuwer**. "Achieving high-performance the functional way: a functional pearl on expressing high-performance optimizations as rewrite strategies". In: *Proc. ACM Program. Lang.* 4.ICFP (2020). **Acceptance Rate 36%**, **selected as only 1 of 4 ACM SIGPLAN Research Highlights from 2020**, **HiPEAC Paper Award**, 92:1–92:29.

[J3] L. Stoltzfus, B. Hagedorn, **M. Steuwer**, S. Gorlatch, and C. Dubach. "Tiling Optimizations for Stencil Computations Using Rewrite Rules in Lift". In: *ACM TACO* 16.4 (2020), 52:1–52:25.

2014 [J4] **M. Steuwer**, M. Haidl, S. Breuer, and S. Gorlatch. "High-Level Programming of Stencil Computations on Multi-GPU Systems Using the SkelCL Library". In: *Parallel Processing Letters* 24.3 (2014). 18 citations on Google Scholar.

[J5] M. Olejnik, **M. Steuwer**, J. N. Dybowski, S. Gorlatch, and D. Heider. "gCUP: Rapid GPU-based HIV-1 Coreceptor Usage Prediction for Next-Generation Sequencing". In: *Bioinformatics* 30.22 (2014). 11 citations on Google Scholar.

[J6] **M. Steuwer** and S. Gorlatch. "SkelCL: A High-Level Extension of OpenCL for Multi-GPU Systems". In: *The Journal of Supercomputing* 69.1 (2014). 19 citations on Google Scholar.

[J7] **M. Steuwer**, M. Friese, S. Albers, and S. Gorlatch. "Introducing and Implementing the Allpairs Skeleton for Programming Multi-GPU Systems". In: *Int. Journal of Parallel Programming* 42.4 (2014). 12 citations on Google Scholar.

2013 [J8] P. Kegel, **M. Steuwer**, and S. Gorlatch. "dOpenCL: Towards uniform programming of distributed heterogeneous multi-/many-core systems". In: *Journal of Parallel and Distributed Computing* 73.12 (2013). 14 citations on Google Scholar.

Conference Papers

2021 [C1] L. Stoltzfus, B. Hamilton, **M. Steuwer**, L. Li, and C. Dubach. "Code Generation for Room Acoustics Simulations with Complex Boundary Conditions". In: *IPDPS*. IEEE, 2021, pp. 485–496.

[C2] T. Koehler and **M. Steuwer**. "Towards a Domain-Extensible Compiler: Optimizing an Image Processing Pipeline on Mobile CPUs". In: *CGO*. IEEE, 2021, pp. 27–38.

[C3] M. Lücke, **M. Steuwer**, and A. Smith. "Integrating a Functional Pattern-based IR into MLIR". In: *Proceedings of the ACM SIGPLAN 2021 International Conference on Compiler Construction, CC 2021, March 2-3, 2021*. ACM, 2021.

2018 [C4] T. Koehler and **M. Steuwer**. "Towards a Domain Extensible Compiler: Optimizing an image processing pipeline on mobile CPUs". In: *Proceedings of the 2021 International Symposium on Code Generation and Optimization, CGO 2021, February 27 - March 3, 2021*. **Acceptance Rate 35%**. ACM, 2018.

2020 [C5] J. M. Morton, K. Kasyk, L. Li, J. Sun, C. Dubach, **M. Steuwer**, M. Cole, and M. F. P. O'Boyle. "DelayRepay: Delayed Execution for Kernel Fusion in Python". In: *Proceedings of the 16th ACM SIGPLAN International Symposium on Dynamic Languages, DLS 2020, November 18, 2020*. Ed. by M. Flatt. 2020.

[C6] F. Pizzuti, **M. Steuwer**, and C. Dubach. "Generating Fast Sparse Matrix Vector Multiplication from a High Level Generic Functional IR". In: *Proceedings of the ACM SIGPLAN 2020 International Conference on Compiler Construction, CC 2020, San Diego, CA, USA, February 22-23, 2020*. San Diego, CA, USA: ACM, 2020.

2018 [C7] P. Ginsbach, T. Remmelg, **M. Steuwer**, B. Bodin, C. Dubach, and M. F. P. O'Boyle. "Automatic matching of legacy code to heterogeneous APIs: An idiomatic approach". In: *Proceedings of the 23rd International Conference on Architectural Support for Programming Languages and Operating Systems, ASPLOS 2018, Williamsburg, VA, USA, March 24-28, 2018*. **Acceptance Rate 17.5%**, **HiPEAC Paper Award**, 18 citations on Google Scholar. Williamsburg, VA, USA: ACM, 2018.

[C8] B. Hagedorn, L. Stoltzfus, **M. Steuwer**, S. Gorlatch, and C. Dubach. "High Performance Stencil Code Generation with Lift". In: *Proceedings of the 2018 International Symposium on Code Generation and Optimization, CGO 2018, Vienna, Austria, February 24-28, 2018*. **Acceptance Rate 29%**, **Best Paper Award Winner**, **76 citations** on Google Scholar. Vienna, Austria: ACM, 2018.

2017 [C9] B. Hagedorn, **M. Steuwer**, and S. Gorlatch. "A Transformation-Based Approach to Developing High-Performance GPU Programs". In: *Perspectives of System Informatics - 11th International Ershov Informatics Conference, PSI 2017, Moscow, Russia, June 26-29, 2017.* Ed. by A. Voronkov and A. K. Petrenko. 2017.

[C10] J. Fumero, **M. Steuwer**, L. Stadler, and C. Dubach. "Just-In-Time GPU Compilation for Interpreted Languages with Partial Evaluation". In: *Proceedings of the 13th ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments, VEE 2017, Xi'an, China, April 8-9, 2017*. **29 citations** on Google Scholar. Xi'an, China: ACM, 2017.

[C11] **M. Steuwer**, T. Remmelg, and C. Dubach. "Lift: A Functional Data-Parallel IR for High-Performance GPU Code Generation". In: *Proceedings of the 2017 International Symposium on Code Generation and Optimization, CGO 2017, Austin, TX, USA, February 4-8, 2017*. **Acceptance Rate 22%**, **153 citations** on Google Scholar, **most cited paper of CGO 2017**. Austin, USA: IEEE, 2017.

2016 [C12] **M. Steuwer**, T. Remmelg, and C. Dubach. "Matrix Multiplication Beyond Auto-Tuning: Rewrite-based GPU Code Generation". In: *Proceedings of the 2016 International Conference on Compilers, Architecture, and Synthesis of Embedded Systems, CASES 2016*. **24 citations** on Google Scholar. Pittsburgh, USA, 2016.

2015 [C13] **M. Steuwer**, C. Fensch, S. Lindley, and C. Dubach. "Generating Performance Portable Code using Rewrite Rules: From High-Level Functional Expressions to High-Performance OpenCL Code". In: *Proceedings of the 20th ACM SIGPLAN International Conference on Functional Programming, ICFP 2015*. **Acceptance Rate 29%**, **133 citations** on Google Scholar, **most cited paper of ICFP 2015**. Vancouver, Canada, 2015.

[C14] J. J. Fumero, T. Remmelg, **M. Steuwer**, and C. Dubach. "Runtime Code Generation and Data Management for Heterogeneous Computing in Java". In: *Proceedings of the Principles and Practices of Programming on the Java Platform, PPPJ 2015*. **22 citations** on Google Scholar. Melbourne, USA, 2015.

2014 [C15] S. Gorlatch and **M. Steuwer**. "Towards High-Level Programming for Systems with Many Cores". In: *Perspectives of Systems Informatics 9th International Andrei Ershov Memorial Conference (PSI 2014)*. St. Petersburg, Russia, 2014.

2013 [C16] **M. Steuwer** and S. Gorlatch. "High-Level Programming for Medical Imaging on Multi-GPU Systems using the SkelCL Library". In: *Proc. of the Int. Conference on Computational Science, (ICCS 2013)*. Vol. 18. Procedia Computer Science. Barcelona, Spain, 2013.

[C17] **M. Steuwer** and S. Gorlatch. "SkelCL: Enhancing OpenCL for High-Level Programming of Multi-GPU Systems". In: *Parallel Computing Technologies 2013*. Lecture Notes in Computer Science. **35 citations** on Google Scholar. St. Petersburg, Russia, 2013.

2012 [C18] **M. Steuwer**, P. Kegel, and S. Gorlatch. "A High-Level Programming Approach for Distributed Systems with Accelerators". In: *New Trends in Software Methodologies, Tools and Techniques – Proceedings of the 11th SoMeT'12*. 2012.

Workshop Papers

2021 [W1] F. Pizzuti, **M. Steuwer**, and C. Dubach. "Generating high performance code for irregular data structures using dependent types". In: *FHPNC@ICFP*. ACM, 2021, pp. 37–49.

2020 [W2] T. Remmelg, B. Hagedorn, L. Li, **M. Steuwer**, S. Gorlatch, and C. Dubach. "High-Level Hardware Feature Extraction for GPU Performance Prediction of Stencils". In: *Proceedings of the 13th ACM Workshop on General Purpose Processing using GPUs, GPGPU@PPoPP 2020*. San Diego, CA, USA, 2020.

[W3] M. Lücke, **M. Steuwer**, and A. Smith. "A functional pattern-based language in MLIR". In: *Proceeding of the workshop on Accelerated Machine Learning, AccML@HiPEAC 2020*. Bologna, Italy, 2020.

2019 [W4] B. Köpcke, **M. Steuwer**, and S. Gorlatch. "Generating efficient FFT GPU code with Lift". In: *Proceedings of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, FHPNC@ICFP 2019*. Berlin, Germany, 2019.

[W5] F. Pizzuti, **M. Steuwer**, and C. Dubach. "Position-dependent arrays and their application for high performance code generation". In: *Proceedings of the 8th ACM SIGPLAN International Workshop on Functional High-Performance and Numerical Computing, FHPNC@ICFP 2019*. Berlin, Germany, 2019.

[W6] B. Köpke, **M. Steuwer**, and S. Gorlatch. "Generating Fast FFT Code for GPU from High-Level, Pattern-Based Abstractions". In: *Proceedings of the International Symposium on High-Level Parallel Programming and Applications, HLPP 2019*. Linköping, Sweden, 2019.

[W7] M. Kristien, B. Bodin, **M. Steuwer**, and C. Dubach. "High-level synthesis of functional patterns with Lift". In: *Proceedings of the 6th ACM SIGPLAN International Workshop on Libraries, Languages and Compilers for Array Programming, ARRAY@PLDI 2019*. Phoenix, AZ, USA, 2019.

[W8] N. Mogers, A. Smith, D. Vytiniotis, **M. Steuwer**, C. Dubach, and R. Tomioka. "Towards Mapping Lift to Deep Neural Network Accelerators". In: *Proceedings of the Workshop on Emerging Deep Learning Accelerators, EDLA@HiPEAC 2019*. Valencia, Spain, 2019.

2018 [W9] G. Brown, C. D. Bella, M. Haidl, T. Remmelg, R. Reyes, and **M. Steuwer**. "Introducing Parallelism to the Ranges TS". In: *Proceedings of the International Workshop on OpenCL, IWOCL 2018*. Oxford, United Kingdom, 2018.

2017 [W10] L. Stoltzfus, C. Dubach, **M. Steuwer**, A. Gray, and S. Bilbao. "A Modular Approach to Performance, Portability and Productivity for 3D Wave Models". In: *Proceedings of the Seventh International Workshop on Domain-Specific Languages and High-Level Frameworks for High Performance Computing, WOLFHPC@SC 2017*. Denver, CO, USA, 2017.

[W11] J. Fumero, **M. Steuwer**, L. Stadler, and C. Dubach. "OpenCL JIT Compilation for Dynamic Programming Languages". In: *Proceedings of the 2017 Workshop on Modern Language Runtimes, Ecosystems, and VMs, MoreVMs@<Programming> 2017*. Brussels, Belgium, 2017.

[W12] M. Haidl, **M. Steuwer**, H. Dirks, T. Hummernbrum, and S. Gorlatch. "Towards Composable GPU Programming: Programming GPUs with Eager Actions and Lazy Views". In: *Proceedings of the 8th International Workshop on Programming Models and Applications for Multicores and Manycores, PMAM@PPoPP 2017*. Austin, USA: ACM, 2017.

2016 [W13] T. Remmelg, T. Lutz, **M. Steuwer**, and C. Dubach. "Performance Portable GPU Code Generation for Matrix Multiplication". In: *Proceedings of the 9th ACM Workshop on General Purpose Processing using GPUs, GPGPU@PPoPP 2016*. **28 citations** on Google Scholar. Barcelona, Spain, 2016.

[W14] M. Haidl, **M. Steuwer**, T. Humernbrum, and S. Gorlatch. "Multi-Stage Programming for GPUs in Modern C++ using PACXX". In: *Proceedings of the 9th ACM Workshop on General Purpose Processing using GPUs, GPGPU@PPoPP 2016*. Barcelona, Spain, 2016.

[W15] A. Harries, **M. Steuwer**, M. Cole, A. Gray, and C. Dubach. "Compositional Compilation for Sparse, Irregular Data Parallelism". In: *Workshop on High-Level Prog. for Heterogeneous and Hierarchical Parallel Systems, HLPGPGPU@HiPEAC 2016*. Prague, Czech Republic, 2016.

[W16] C. Cummins, P. Petoumenos, **M. Steuwer**, and H. Leather. "Towards Collaborative Performance Tuning of Algorithmic Skeletons". In: *Workshop on High-Level Prog. for Heterogeneous and Hierarchical Parallel Systems, HLPGPGPU@HiPEAC 2016*. Prague, Czech Republic, 2016.

[W17] C. Cummins, P. Petoumenos, **M. Steuwer**, and H. Leather. "Autotuning OpenCL Workgroup Size for Stencil Patterns". In: *Proceedings of the 2016 International Workshop on Adaptive Self-tuning Computing Systems, ADAPT@HiPEAC 2016*. **25 citations** on Google Scholar. Prague, Czech Republic, 2016.

2014 [W18] J. J. Fumero, **M. Steuwer**, and C. Dubach. "A Composable Array Function Interface for Heterogeneous Computing in Java". In: *Proceedings of the 2014 ACM SIGPLAN International Workshop on Libraries, Languages, and Compilers for Array Programming, ARRAY@PLDI 2014*. **25 citations** on Google Scholar. Edinburgh, Scotland, 2014.

[W19] S. Breuer, **M. Steuwer**, and S. Gorlatch. "Extending the SkelCL Skeleton Library for Stencil Computations on Multi-GPU Systems". In: *Proceedings of the 1st International Workshop on High-Performance Stencil Computations, HiStencils@HiPEAC 2014*. 18 citations on Google Scholar. Vienna, Austria, 2014.

2012 [W20] **M. Steuwer**, P. Kegel, and S. Gorlatch. "Towards High-Level Programming of Multi-GPU Systems Using the SkelCL Library". In: *IEEE International Symposium on Parallel and Distributed Processing Workshops, Accelerators and Hybrid Exascale Systems, ASHES@IPDPS 2012*. **21 citations** on Google Scholar. 2012.

[W21] **M. Steuwer**, S. Gorlatch, M. Buß, and S. Breuer. "Using the SkelCL Library for High-Level GPU Programming of 2D Applications". In: *Euro-Par 2012: Parallel Processing Workshops, Paraphrase@EuroPar 2012*. Lecture Notes in Computer Science. Rhodes Island, Greece, 2012.

[W22] P. Kegel, **M. Steuwer**, and S. Gorlatch. "dOpenCL: Towards a Uniform Programming Approach for Distributed Heterogeneous Multi-/Many-Core Systems". In: *IEEE International Symposium on Parallel and Distributed Processing Workshops, Heterogeneity in Computing Workshop, HCW@IPDPS 2012*. **49 citations** on Google Scholar. 2012.

2011 [W23] **M. Steuwer**, P. Kegel, and S. Gorlatch. "SkelCL - A Portable Skeleton Library for High-Level GPU Programming". In: *IEEE International Symposium on Parallel and Distributed Processing Workshops, Workshop on High-Level Parallel Programming Models & Supportive Environments, HIPS@IPDPS 2011*. **173 citations** on Google Scholar. 2011.

Technical Reports

2021 [T1] R. Fu, X. Qin, O. Dardha, and **M. Steuwer**. *Row-Polymorphic Types for Strategic Rewriting*. 2021.

2020 [T2] B. Hagedorn, J. Lenfers, T. Koehler, S. Gorlatch, and **M. Steuwer**. *A Language for Describing Optimization Strategies*. 2020.

2018 [T3] G. Brown, C. D. Bella, M. Haidl, T. Remmelg, R. Reyes, **M. Steuwer**, and M. Wong. *P0836R0 Introduce Parallelism to the Ranges TS*. C++ Standards Committee Papers. 2018.

2017 [T4] R. Atkey, **M. Steuwer**, S. Lindley, and C. Dubach. *Strategy Preserving Compilation for Parallel Functional Code*. 2017.

Book Chapters

2016 [B1] **M. Steuwer**. "Verbesserung der Programmierbarkeit und Performance-Portabilität von Manycore-Prozessoren (Improving Programmability and Performance Portability on Many-Core Processors)". In: *Ausgezeichnete Informatikdissertationen 2015 (Distinguished Dissertations in Informatics 2015)*. Ed. by S. Hölldobler. Lecture Notes in Informatics. German Informatics Society, 2016.

2014 [B2] C. Kessler, S. Gorlatch, J. Emmyren, U. Dastgeer, **M. Steuwer**, and P. Kegel. "Skeleton Programming for Portable Many-Core Computing". In: *Programming Multi-core and Many-core Computing Systems*. Wiley, 2014.

2013 [B3] P. Kegel, **M. Steuwer**, and S. Gorlatch. "Uniform High-Level Programming of Many-Core and Multi-GPU Systems". In: *Transition of HPC Towards Exascale Computing*. Vol. 24. Advances in Parallel Computing. IOS Press, 2013.

Thesis

2015 [TH1] **M. Steuwer**. "Improving Programmability and Performance Portability on Many-Core Processors". Grade: *Summa Cum Laude*, Supervied by Prof. Sergei Gorlatch, **Nominated** for the **prize for best dissertation** awarded by the German Informatics Society. PhD thesis. University of Münster, 2015.

Talks and Presentations

08/2020 Invited Lectures: *Compiler Intermediate Representations*
Scottish Programming Language and Verification Summer School
Virtual event hosted by the University of Edinburgh, UK.

06/2020 Talk: *Achieving High-Performance the Functional Way — Expressing High-Performance Optimizations as Rewrite Strategies*
Scottish Programming Languages Seminar, Virtual event hosted by the University of Sterling, UK.

09/2019 **Invited Talk**: *ELEVATE: a language to write composable program optimizations*
Google DeepMind, London, UK.

02/2019 **Invited Talk**: *Lift: Generating High Performance Code with Rewrite Rules*
Programming Languages and Software Engineering Group, **University of Washington in Seattle**, US.

02/2019 **Invited Talk**: *Lift: Generating High Performance Code with Rewrite Rules*
Microsoft Research in Redmond, US.

12/2018 Talk: *Implementing lambda calculus in Python and C++*
Programming Languages at Glasgow (PLUG), University of Glasgow, UK.

11/2018 Talk: *High-level Features – Low-level Performance: GPU Performance Prediction of Stencils*
System Seminar, University of Glasgow, UK.

09/2018 **Invited Talk**: *Generating Performance Portable Code with Lift*
Shonan Meeting No.134: Advances in Heterogeneous Computing from Hardware to Software, Japan.

03/2018 **Invited Talk**: *Lift: Code Generation by Rewriting Algorithmic Skeletons*
Dagstuhl Seminar 18111 on Loop Optimizations, Schloss Dagstuhl, Germany.

02/2018 **Invited Talk**: *Programming GPUs with Eager Actions and Lazy Views*
Compiler and Architecture Design Group Seminar, University of Edinburgh, UK.

02/2018 Talk: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*
Formal Analysis, Theory and Algorithms Seminar, University of Glasgow, UK.

11/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*
System Seminar, University of Glasgow, UK.

10/2017 Talk: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*
System Seminar, University of Glasgow, UK.

10/2017 **Invited Talk**: *The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules*
Microsoft Research Labs in Cambridge, UK.

09/2017 **Invited Talk**:
The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules
University of Hull HPC Symposium 2017 at the University of Hull, UK.

07/2017 **Invited Talk**:
The Lift Project: Performance Portable Parallel Code Generation via Rewrite Rules
University of Münster, Germany.

06/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*
Scottish Programming Languages Seminar at the University of the West of Scotland in Paisley, UK.

04/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*
C++ Edinburgh Meetup in Edinburgh, UK.

02/2017 Talk: *Lift: A Functional Data-Parallel IR for High-Performance GPU Code Generation*
International Symposium on Code Generation and Optimization (CGO) 2017 in Austin, USA.

02/2017 Talk: *Programming GPUs with Eager Actions and Lazy Views*
International Workshop on Programming Models and Applications for Multicores and Manycores (PMAM) 2017 in Austin, USA.

12/2016 **Invited Talk**: *The Lift Project: Performance Portable GPU Code Generation via Rewrite Rules*
Computer Laboratory Systems Research Group Seminar, **University of Cambridge**, UK.

08/2016 **Invited Talk**:
Structured Parallel Programming — From High-Level Functional Expressions to High-Performance OpenCL Code
Center for Advanced Electornics Dresden, Dresden University of Technology, Germany.

05/2016 **Invited Talk**:
Improving Programmability and Performance Portability on Many-Core Processors
Colloquium of candidates nominated for the *prize for best dissertation* awarded by the German Informatics Society, Schloss Dagstuhl, Germany.

04/2016 **Invited Talk**: *The lift Project: Performance Portability via Rewrite Rules*
Saarland University, Germany.

01/2016 **Invited Talk**: *Performance Portable GPU Code Generation*
Imperial College London, UK.

12/2015 Talk: *Functional Programming in C++*
Programming Language Interest Group at Edinburgh University, UK.

10/2015 **Invited Talk**: *Generating Performance Portable Code using Rewrite Rules*
Imperial College London, UK.

09/2015 Talk: *Generating Performance Portable Code using Rewrite Rules:*
From High-Level Functional Expressions to High-Performance OpenCL Code
International Conference on Functional Programming (ICFP) 2015 in Vancouver, Canada.

06/2015 Talk: *Generating Performance Portable Code using Rewrite Rules*
Scottish Programming Languages Seminar in St. Andrews, UK.

05/2014 **Invited Talk**: *SkelCL: High-Level Programming of Multi-GPU Systems*
Institute for Computational and Applied Mathematics, University of Münster, Germany.

05/2014 **Invited Talk**: *SkelCL: High-Level Programming of Multi-GPU Systems*
Workshop on Fast Data Processing on GPUs in Dresden, Germany.

01/2014 Talk: *Extending the SkelCL Library for Stencil Computations on Multi-GPU Systems*
HiStencils 2014 workshop in Vienna, Austria.

12/2013 **Invited Talk**: *SkelCL: High-Level Programming of Multi-GPU Systems*
Research group on elementary particle physics, University of Wuppertal, Germany.

07/2013 Talk: *Introducing and Implementing the Allpairs Skeleton for GPU Systems*
HLPP 2013 workshop in Paris, France.

06/2013 Talk:*High-Level Programming for Medical Imaging on Multi-GPU Systems*
using the SkelCL Library
ICCS 2013 conference in Barcelona, Spain.

08/2012 Talk: *Using the SkelCL Library for High-Level GPU Programming of 2D Applications*
ParaPhrase 2012 workshop held in conjunction with Euro-Par 2012 in Rhodes, Greece.

06/2012 Talk: *High-Level Programming for Heterogeneous Systems with Accelerators*
PDESoft 2012 workshop in Münster, Germany.

05/2012 Talk:*Towards High-Level Programming of Multi-GPU Systems Using the SkelCL Library*
AsHES 2012 workshop held in conjunction with IPDPS 2012 in Shanghai, China.

04/2012 **Invited talk**: *A Skeleton Library for Heterogeneous Multi-/Many-Core Systems*
NAIS workshop in Edinburgh, UK.

01/2012 Talk: *Towards a High-Level Approach for Programming Distributed Systems with GPUs*
COST Action IC0805 ("ComplexHPC") meeting in Timisoara, Romania.

12/2011 **Invited talk**: *SkelCL — A High-Level Programming Library for GPU Programming*
Jülich Supercomputing Centre (JSC), Germany.

05/2011 Talk: *SkelCL — A Portable Skeleton Library for High-Level GPU Programming*
HIPS 2011 workshop held in conjunction with IPDPS 2011 in Anchorange, Alaska, USA.

09/2008 **Invited talk**: *Development of an Online Game as a Student Project*
ITSoftTEAM workshop in Chernihiv, Ukraine.

Teaching Experience

As a Lecturer at the University of Edinburgh.

2020 - 2021
- Supporting lecturer for *Operating Systems*, undergraduate course, course lead by Antonio Barbalace. About 150 students.

As a Lecturer at the University of Glasgow.

2019 - 2020
- *Systems Programming*, undergraduate course. About 200 students.
- *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Craig Macdonald, Iadh Ounis, and Lito Michala. About 200 students.

2018 - 2019
- *Systems Programming*, undergraduate course. About 180 students.
- *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Inah Omoronyia, and Jeff Dalton. About 180 students.

2017 - 2018
- *Operating Systems*, undergraduate course, together with Wim Vanderbauwhede. About 80 students.
- *Professional Software Development Team Project*, undergraduate course, together with Tim Storer, Inah Omoronyia, and Joemon Jose. About 160 students.
- *MSc CS+ Team Project*, topic: *Developing a visual tool for exploring rewriting*. 6 Students.

As a postdoctoral researcher at the University of Edinburgh.

2016 - 2017
- Guest Lecture on *DSLs and rewrite-based optimizations for performance-portable parallel programming* in the *Elements of Programming Languages* course given by James Cheney.
- Guest Lecture in the *Compiling Techniques* course given by Christophe Dubach.
- Assistance in the tutorials of the *Compiling Techniques* course given by Christophe Dubach.

2015 - 2016
- Organiser and Lecturer of the C++ programming course *The Humble C++ Programmer* aiming to improve PhD students coding skills.
- Guest Lecture on *DSLs and rewrite-based optimizations for performance-portable parallel programming* in the *Elements of Programming Languages* course given by James Cheney.
- Assistance in the tutorials of the *Compiling Techniques* course given by Christophe Dubach.

2014 - 2015
- Guest Lecture in the *Compiling Techniques* course given by Christophe Dubach.

As a research associate at the University of Münster.

2013 - 2014
- Supervised MSc student projects: *Design and implementation of a high-level API for programming heterogeneous clusters* and *High-level programming of online games in future generation networks*.

2012 - 2013
- Course Design and Lecturer: *Introduction to programming with C and C++*.
- Teaching assistant: *Multi-core and GPU: Parallel Programming*.
- Teaching assistant: *Operating Systems*.

2011 - 2012
- Supervised MSc student project: *High-level programming of heterogeneous systems*.
- Teaching assistant: *Multi-core and GPU: Parallel Programming*.
- Teaching assistant: *Technical aspects of cloud computing* seminar.
- Teaching assistant: *Operating Systems*.

2010 - 2011
- Supervised UG/MSc student project: *Internet- and GPU-based Cloud Computing*.
- Course Design and teaching assistant: *Multi-core and GPU: Parallel Programming*.
- Supervised UG student project: *High-level GPU programming*.

Supervised Undergraduate and Master Students

As a Lecturer at the University of Edinburgh.

since 09/2021 MInf project of Limrod Libman on *Applying the K Framework to specify the semantics of Domain-Specific Languages*

06/2021 - 08/2021 MSc project of Pingru Chen on *Templates for making correct graphs in research papers in the robotics domain*

06/2021 - 08/2021 MSc project of Zairan Xu on *Developing templates for better visualisation in machine learning research papers*

06/2021 - 08/2021 MSc project of Siqi Zong on *Templates for making correct graphs in research papers in the NLP domain*

As a Lecturer at the University of Glasgow.

09/2019 - 03/2020 Final year project of Xueying Qin on *Proving the correcness of rewrite rules in Agda*

09/2019 - 03/2020 Final year project of Sarah Ashworth on *Implementation of pattern-based computations on an FPGA*

09/2019 - 03/2020 Final year project of Euan Mcgrevey on *Optimizing image processing applications by rewriting*

09/2019 - 03/2020 Final year project of Darius Darulis on *Predicting the performance of rewritten program variations*

09/2019 - 03/2020 Final year project of David Wood on *Optimizing the compilation time of the Rust compiler*

06/2018 - 09/2019 Final year project of Ryan Maloney on *UFC Fight Prediction Web App*

06/2018 - 09/2019 Final year project of Stuart Rawlinson on *Scansion: A Poetry Analysis Web Application*

06/2018 - 09/2019 Final year project of Junjie Shentu on *Development of Ordering Application in Restaurants*

06/2018 - 09/2019 Final year project of Liam James on *Developing an Android Food Rating Application for Armature Chefs*

09/2018 - 03/2019 Final year project of Hansheng Zhang on *Multi-Level Parallel Applications with the C++ Parallel STL*

09/2018 - 03/2019 Final year project of Dimitar Borisov on *Exploiting specialised hardware for general purpose computing*

09/2017 - 03/2018 Final year project of Domantas Jurkus on *Computer Vision Applications with the Parallel STL*

09/2017 - 03/2018 Final year project of Matthew Cornetto on *Sorting Algorithms on GPUs*

As a research associate co-supervised with Sergei Gorlatch at the University of Münster.

09/2016 MSc thesis of Bastian Hagedorn on *Efficient GPU Code Generation for Stencil Computations via Parallel Patterns*

07/2014 Bachelor thesis of André Lüers on *Evaluation of the Skeleton Library FastFlow*

07/2014 Bachelor thesis of Lars Klein on *A Parallel Implementation of the T-CUP Software using the SkelCL Library*

01/2014 Master thesis of Michael Olejnik on *A GPU-based Classification Framework for HIV Resistance Prediction*

01/2014 Master thesis of Stefan Breuer on *Extending the SkelCL Library for Stencil Computations*

11/2013 Diploma thesis of Wadim Hamm on *Development of a Divide & Conquer Skeleton for SkelCL*

07/2013 Bachelor thesis of Matthias Droste on *Evaluation of the Skeleton Library SkePU*

06/2013 Bachelor thesis of Kai Kientopf on *Implementation of the Needleman-Wunsch Algorithm and the Breath-First-Search with SkelCL*

06/2013 Master thesis of Florian Quinkert on *A Model for Predicting Work Distribution in Heterogeneous Systems and its Implementation in SkelCL*

03/2013 Master thesis of Malte Friese on *Extending the Skeleton Library SkelCL with a Skeleton for Allpairs Computations*

03/2013 Bachelor thesis of Sebastian Mißbach on *Implementing the LU-Decomposition and the Mersenne-Twister with the SkelCL Library*

03/2013 Bachelor thesis of Patrick Schiffler on *Performance Analysis of SkelCL using B+ Tree Traversal and 3D Jacobi Stencil Computation*

01/2013 Diploma thesis of Markus Blank-Burian on
Simulation and Analysis of Two-Dimensional Turbulences on Parallel Computer Architectures

06/2012 Diploma thesis of Matthias Buß on
Adding Multidimensional Data Types to the Multi-GPU Skeleton Library SkelCL

09/2011 Bachelor thesis of Michael Olejnik on
Investigating the Use of GPUs for Radix Sort

09/2011 Bachelor thesis of Jan Gerd Tenberge on
Extending the SkelCL Library with Iterators

08/2011 Bachelor thesis of Stefan Breuer on
Enhancing SkelCL's MapOverlap Skeleton

08/2011 Bachelor thesis of Tobias Günnewig on
Developing a Library for Manipulating Source Code of C-based Languages