Cosmin E Oancea: Curriculum Vitae (CV)

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Research Interests

Interests in a variety of topics from computer system field, including programming language design and implementation, optimizing compilers for highly-parallel systems, high-performance implementation of AI algorithms, parallel algorithms, memory management, computer algebra.

Academic Positions and Education

Associate Professor, DIKU, University of Copenhagen, Denmark. Dec. 2017 - present.
Assistant Professor, DIKU, University of Copenhagen, Denmark. Dec. 2013 - 2017.
Post-Doctoral Fellow, DIKU, University of Copenhagen, Denmark. Dec. 2011 - 2013.
Post-Doctoral Fellow, Texas A&M University, College Station, USA. Sept. 2009 - Oct. 2011.
Post-Doctoral Fellow, University of Cambridge, UK. 2007-09.
Ph.D. in Computer Science, Oct 2000 - Nov 2005. Ph.D. Advisor: Stephen Watt.
"Parametric Polymorphism for Software Component Architectures and Optimizations."
Computer Science Department, The University of Western Ontario, London, ON, Canada.

Selected Awards and Bursaries

- Nominated to "KU Teacher of the Year Award", 2021.
- Best paper award at TFP'21.
- HiPEAC 2017 and 2018 Paper Award.
- "DIKU Teacher of the Year Award", twice in 2013 and 2015.
- Special DIKU Recognition Award, 2014 (for work in revising the bachelor program).
- NSERC Post-Doctoral Scholarship, December 2007 - 2009 (80000CAD)

Selected Program Committee Work

- **Vice-Chair:** Programming Models track of IEEE Int. Parallel & Distributed Processing Symposium (IPDPS), 2018.
- **Co-Chair:** Workshop on Functional High-Performance Computing (FHPC), 2017.
- **PC member (top conferences):**
  - Int. Conf. for High Perf. Computing, Networking, Storage and Analysis (SC), 2022
  - Int. Conf. on Parallel Computing (ICPP 2018,2019, 2022),
  - Int. Conf. on Parallel Architectures and Compilation Techniques (PACT 2015,2016,2019),
  - Int. Symp. on Principle and Practice of Parallel Programming (PPoPP 2017,2019,2021,2023),
  - EuroPar 2020, Int. Conf. on Supercomputing (ICS 2014).

Recent Invited Talks

- "AD for an Array Language Supporting Nested Parallelism", MIAPbP, June 7, 2023.
- "Futhark: a vehicle for exploring compiler optimization of correct-by-construction parallel programs", AMD Tech Talk, 15th of July, 2022.
- "Dataset Sensitive Autotuning of Multi-versioned Code Based on Monotonic Properties", Workshop on Generic Autotuning Technology for GPU Applications Workshop, Lorentz Center, Netherlands, 7th of March 2022.
- "Reverse AD for an Array Language with Nested Parallelism", ERCIS Lunchtime Seminar, University of Munster, Germany, 14th of December 2021,
- "Prototyping Parallel Implementations of Machine-Learning Algorithms in Futhark", Nvidia cuML team, 10th of November, 2020.

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Supervision

Post-Doctoral mentoring of Troels Henriksen (2018-2020), Stefan Oehmcke (2022-present), David Gray Marchant (2023-present),

PhD supervisor of Nikolaj Hinnerskov (in progress), Philip Munksgaard (defended 2023), Wojciech Michal Pawlak (defended 2020), Troels Henriksen (defended 2018).

MSc/BSc: eight MSc and three BSc students in 2023. Similar in previous years.

Teaching

2014-present Programming Massively Parallel Hardware (PMPH), MSc level, 7.5 ECTS,

2019-present Data-Parallel Programming (DPP), MSc level, 7.5 ECTS,

2021-present KOMIT Grundlaeggende Datalogi, 1^{st} year BSc course, 15 ECTS,

2012-2019 Implementation of Programming Languages, 2^{nd} year BSc, 7.5 ECTS.

Other

local organizer for PLDI'24 in Copenhagen (together with Fritz Henglein).

External Funding

Role	Funding Source/Amount	Project Title	From	To
CO-PI	UCPH Data Plus 1.649.500 DKK	High-Performance Land Change Assessment	2022	2024
CO-PI	DFF-Research Project 1 2.500.000 DKK	Monitoring Changes in Big Satellite Data via Massively Parallel AI	2019	2024
CO-PI	DFF-Research Project 2 5.903.550 DKK	FUTHARK: Functional Technology for High-performance Architectures	2018	2023
University Co-Adviser	Inovation Found 1.072.000 DKK	Industrial PhD at SimCorp (Wojciech Michal Pawlak)	2017	2020
Junior Inverstigator	The Danish Industry Foundation 5.000.000 DKK	Industrial Data Analysis Service (IDAS)	2015	2020
Investigator	Danish Council for Strategic Research (DSF) 31.416.136 DKK	Functional high-performance computing for financial information technology (HIPERFIT), grant no. 10-092299	2010	2017

Publication Summary

Cosmin has co-authored over forty refereed articles in international peer-reviewed conference proceedings and journals including premiere forums (marked with ** in publication list) in fields such as programming language design and implementation (PLDI, PPoPP, ICFP, OOPSLA), compiler optimization (TACO, CGO), high-performance computing (SC), data engineering (ICDE), machine learning (ICML, Knowledge-Based System Journal), parallel algorithms (SPAA), computer algebra (ISSAC), memory management (ISMM).

google scholar & acm profiles

Google Scholar: Citation count: 1111, H-index: 21, i10-Index: 28
`https://scholar.google.dk/citations?user=RpmM52IAAAAJ&hl=en`
ACM profile: 550 citations, 31 publications `https://dl.acm.org/profile/81100509575`

Compiler Work

Polaris: studied how to unify static and dynamic analysis for the purpose of automatic parallelization of Fortran loops (with Lawrence Rauchwerger Texas A&M).

Futhark: co-architected the core data-parallel language of Futhark and its optimizing compiler. Futhark has been found to offer performance competitive with hand-written, low-level GPU code on a number of benchmarks, has been used in inter-disciplinary collaboration, e.g., in remote sensing, finance and image processing, and has generated more than 50 MSc or BSc theses; see Futhark's webpage: `https://futhark-lang.org`.

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Refereed Conference Proceedings and Journals

[1] L. M. Bruun, U. S. Larsen, N. Hinnerskov and **C. E. Oancea**, "Reverse-Mode AD of Reduce-by-Index and Scan in Futhark", *In Procs. of Symposium on Implementation and Application of Functional Languages (IFL'23)*, 2023.

[2] D. Serykh, S. Oehmcke, **C. Oancea**, D. Masiliunas, Jan Verbesselt, Y. Cheng, S. Horion, F. Gieseke and N. Hinnerskov, "Seasonal-Trend Time Series Decomposition on Graphics Processing Units", *Procs of BigData*, 2023.

[3] P. Munksgaard, **C. E. Oancea** and T. Henriksen, "Compiling a functional array language with non-semantic memory information", *Procs. of Symposium on Implementation and Application of Functional Languages (IFL'22)*, 2023.

[4]**** R.Schenck, O. Rønning, T. Henriksen and **C. E. Oancea**, "AD for an Array Language with Nested Parallelism", *Procs of Int. Conf. for High Performance Computing, Networking, Storage and Analysis (SC)*, 2022.

[5]**** P. Munksgaard, T. Henriksen, P. Sadayappan and **C. E. Oancea**, "Memory Optimizations in an Array Language", *Procs of Int. Conf. for High Performance Computing, Networking, Storage and Analysis (SC)*, 2022.

[6] P. Munksgaard, S. Breddam, T. Henriksen, F. Gieseke and **C. E. Oancea**, "Dataset Sensitive Autotuning of Multi-Versioned Code based on Monotonic Properties", *22nd Int. Symp. on Trends in Functional Programming (TFP)*, 2021, **best paper award**.

[7] W. Pawlak, M. Hlava, M. Metaksov and **C. E. Oancea**, "Acceleration of Lattice Models for Pricing Portfolios of Fixed-Income Derivatives", *Int. Workshop on Libraries, Languages and Compilers for Programming (ARRAY)*, 2021.

[8] **C. E. Oancea**, T. Robroek and F. Gieseke, "Approximate Nearest-Neighbour Fields via Massively-Parallel Propagation-Assisted KD Trees", *IEEE Int. Conf. on Big Data, special track of Machine Learning and Big Data (MLDB)*, 2020.

[9]**** T. Henriksen, S. Hellfritzsch, P. Sadayappan and **C. E. Oancea**, "Compiling Generalized Histograms for GPU", *Int. Conf. for High Performance Computing, Networking, Storage and Analysis (SC)*, 2020.

[10]**** F. Gieseke, S. Rosca, T. Henriksen, J. Verbesselt and **C. E. Oancea**, "Massively-Parallel Change Detection for Satellite Time Series Data with Missing Values", *IEEE 36th International Conference on Data Engineering (ICDE)*, pages 385-396, 2020.

[11] W. Pawlak, M. Elsman and **C. E. Oancea**, "A Functional Approach to Accelerating Monte Carlo based American Option Pricing", *31st Int. Symp. on Implementation and Application of Functional Languages (IFL'19)*. Singapore. September, 2019.

[12]**** T. Henriksen, F. Thorøe, M. Elsman and **C. E. Oancea**, "Incremental Flattening for Nested Data Parallelism", *Int. Symp. on Principles and Practice of Parallel Programming (PPoPP)*, pp 53–67, Washington D.C., US, 2019.

[13]**** M. Elsman, T. Henriksen, D. Annenkov and **C. E. Oancea**, "Static Interpretation of Higher-order Modules in Futhark: Functional GPU Programming in the Large", *Proc. ACM Program. Lang. (ICFP'18)*, pp 97:1–97:30, St. Louis, US, 2018.

[14] T. Henriksen, M. Elsman and **C. E. Oancea**, "Modular Acceleration: Tricky Cases of Functional High-Performance Computing", *Procs. of Workshop on Functional High-Performance Computing (FHPC)*, St. Louis, US, 2018.

[15]****** T. Henriksen, N. G. Serup, M. Elsman, F. Henglein and **C. E. Oancea**, "Futhark: Purely Functional GPU-programming with Nested Parallelism and In-place Array Updates", *Int. Conf. Programming Languages Design and Implementation (PLDI)*, Barcelona, Spain, 2017.

[16]****** F. Gieseke, **C. E. Oancea** and C. Igel. "Bufferkdtree: A Python library for massive nearest neighbor queries on multi-many-core devices", *Knowledge-Based Systems Journal*, 120:1–3, 2017.

[17] F. Gieseke, **C. E. Oancea**, A. Mahaba, C. Igel and T. Heskes. "Bigger Buffer k-d Trees on Multi-Many-Core System", *In Workshop on Big Data & Deep Learning in HPC*, 172-180, 2016.

[18] T. Henriksen, M. Dybdal, H. Urms, A. S. Kiehn, D. Gavin, H. Abelskov, M. Elsman and **C. Oancea**, "APL on GPUs: A TAIL from the Past, Scribbled in Futhark", 5^{th} *Int. Workshop on Functional High Performance Computing (FHPC)*, Nara, Japan, 2016.

[19] T. Henriksen, K. F. Larsen and **C. E. Oancea**, "Design and GPGPU Performance of Futhark's Redomap Construct", 3^{rd} *Int. Workshop on Libraries, Languages and Compilers for Programming (ARRAY)*, pp 17–24, Santa Barbara, US, 2016.

[20]****** C. Andreetta, V. Begot, J. Berthold, M. Elsman, F. Henglein, T. Henriksen, M. Nordfang and **C.E. Oancea**, "FinPar: A Parallel Financial Benchmark", *ACM Journal Trans. Archit. Code Optim. (TACO)*, vol. 13(2), pp. 18.1–18.27, 2016.

[21]****** **C. E. Oancea** and L. Rauchwerger, "Scalable Conditional Induction Variables (CIV) Analysis, *13th Int. Symp. on Code Generation and Optimization (CGO)*, pp. 213–224, San Francisco, California, 2015.

[22]****** F. C. Gieseke, J. Heinermann, **C. E. Oancea** and C. Igel, "Buffer k-d trees: processing massive nearest neighbor queries on GPUs", 31^{st} *Int. Conf. on Machine Learning (ICML)*, pp. 172-180, Beijing, China, 2014.

[23] F. C. Gieseke, k. L. Polsterer, **C. E. Oancea** and C. Igel, "Speedy Greedy Selection: Better Redshift Estimation via Massive Parallelism", 22^{nd} *European Symposium on Artificial Neural Networks (ESANN)*, pp. 87-92, Belgium, 2014.

[24] T. Henriksen, M. Elsman and **C. E. Oancea**, "A Hybrid Approach to Size Inference in Futhark", 3^{rd} *Int. Workshop on Functional High Performance Computing (FHPC)*, Guthenburg, Sweden, 2014.

[25] T. Henriksen and **C. E. Oancea**, "Bounds Checking: An Instance of Hybrid Analysis", 1^{st} *Int. Workshop on Libraries, Languages and Compilers for Programming (ARRAY)*, Edinburgh, UK, 2014.

[26] T. Henriksen, and **C. E. Oancea**, "A T2 Graph-Reduction Approach to Fusion", 2^{nd} *Int. Workshop on Functional High Performance Computing (FHPC)*, Boston, US, 2013.

[27] **C. E. Oancea** and L. Rauchwerger, "A Hybrid Approach to Proving Memory Reference Monotonicity", *24st Annual Workshop Languages and Compilers for Parallel Computing (LCPC)*, LNCS Vol. 7146, pp 61–75, Fort Collins, CO, USA, 2013.

[28]** **C. E. Oancea** and L. Rauchwerger, "Logical Inference Techniques for Loop Parallelization", *In ACM Procs. 33rd Int. Conf. on Programming Language Design and Implementation (PLDI)*, pp 509–520, Beijing, China, 2012.

[29] **C. E. Oancea**, C. Andreetta, J. Berthold, A. Frisch and F. Henglein. "Financial software on GPUs: between Haskell and Fortran." *In Procs of ACM Workshop on Functional high-performance computing (FHPC)*, pp 61–72, Copenhagen, Denmark, 2012.

[30] **C. E. Oancea** and S. M. Watt, "An Architecture for Generic Extensions", *Science of Computer Progr. Journal*, Elsevier, Vol.76(4), pp 258–277, doi:10.1016/j.scico.2009.09.008, 2011.

[31]** **C. E. Oancea**, A. Mycroft and T. Harris, ' "A Lightweight In-Place Implementation for Software Thread-Level Speculation", *In Procs. 21st ACM Symposium on Parallelism in Algorithms and Architectures (SPAA)*, pp: 223–232, Calgary, Canada, 2009.

[32]** **C. E. Oancea**, A. Mycroft, and Stephen M. Watt, "A New Approach to Parallelising Tracing Algorithms", *In Procs. Int. Symposium on Memory Management (ISMM)*, pp: 10–19, Dublin, Ireland, 2009.

[33] **C. E. Oancea** and A. Mycroft, "Set-Congruence Dynamic Analysis for Software Thread-Level Speculation" *21st Annual Workshop Languages and Compilers for Parallel Computing (LCPC)*, LNCS 5535, pp 156–171, Edmonton, Canada, 2008.

[34] **C. E. Oancea** and A. Mycroft, "Software Thread-Level Speculation: an Optimistic Library Implementation", *In Procs. Int. Workshop on Multicore Software Engineering (IWMSE)*, pp 23–32 (ACM Digital Library), Leipzig, Germany, 2008.

[35] **C. E. Oancea** and S. M. Watt, "Generic Library Extension in a Heterogeneous Environment", *In Procs. Workshop on Library-Centric Software Design LCSD*, pp. 25–35, Portland, USA, 2006. (Extended and improved in [13].)

[36]** **C. E. Oancea** and S. M. Watt, "Parametric Polymorphism for Software Component Architectures," *ACM Procs of 20st Int. Conf. Object-Oriented Programming, Systems, Languages and Applications (OOPSLA)*, pp. 147–166, San Diego, USA, 2005.

[37]** **C. E. Oancea** and S. M. Watt, "Domains and Expressions: An Interface Between Two Approaches to Computer Algebra," *In ACM Procs. of the Int. Symposium on Symbolic and Algebraic Computation (ISSAC)*, pp. 261–269, Beijing, China, 2005.

[38] **C. E. Oancea**, J. W. Selby, M. Giesbrecht, and S. M. Watt, "Distributed Models of Thread Level Speculation," *In Procs. Int. Conf. on Parallel and Distributed Processing Techniques and Applications (PDPTA)*, pp. 920–927, Las Vegas, USA, 2005.

[39] **C. E. Oancea**, C. So, and S. M. Watt, "Generalization in Maple," *Maple Conference*, pp. 377–382, Waterloo, ON, Canada, 2005.

[40] Y. Chicha, M. Lloyd, **C. E. Oancea**, and S. M. Watt, "Parametric Polymorphism for Computer Algebra Software Components," *In Procs. 6th Int. Symp. on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, pp. 119–130, Timisoara, Romania, 2004.

[41] **C. E. Oancea** and S. M. Watt, "A Framework for Using Aldor Libraries with Maple," *In Procs. EACA*, pp. 219–224, June 2004, Universidad de Santander, Spain.

[42] F. Boulier, M. Moreno Maza, and **C. E. Oancea**, "A new henselian construction and its application to polynomial GCDs over direct products of fields," *In Procs. EACA*, pp. 47–52, June 2004, Universidad de Santander, Spain.

[43] R. G. Belu, **C. E. Oancea**, and A. C. Belu, "A Wavelet-Based Simulation for Identification and Classification of Short-Term Power Disturbances and Transients," *In Procs Annual ASEE Conference*, pp. 1380–4. June 2003, Nashville, USA.

[44] R. G. Belu and **C. E. Oancea**, "A 2-D indoor radio propagation modeling," *In Procs. FIE (Frontiers in Education) Conference*, pp. 1780–4. November 2003, Boulder, CO, USA.