Fredrik Berg Kjoelstad

Assistant Professor, Computer Science

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Academic Positions

2020–present **Assistant Professor**, *Stanford University*.

Education

February 2020 **Ph.D., Computer Science**, *Massachusetts Institute of Technology*.
Thesis: Code Generation for Sparse Computation
Adviser: Saman Amarasinghe
Award: First Place MIT EECS George M. Sprowls PhD Thesis Award in Computer Science, 2020

August 2011 **M.S. Computer Science**, *University of Illinois at Urbana-Champaign*.
Thesis: Refactoring Transformations for Maintainable, Scalable and Efficient Parallelism
Adviser: Marc Snir
Award: Best Poster Award at the UIUC Grad Expo (M.S. and Ph.D.).

June 2005 **B.E., Computer Science**, *Norwegian University of Science and Technology in Gjøvik*.
Bachelor project: Stopmotion
Awards: Rosing Student Award from the Norwegian Computer Society and Eureka Award from the Norwegian University of Science and Technology in Gjøvik.

Publications

Conference and Journal Publications

1. Compiler Support for Sparse Tensor Computations in MLIR. Aart J.C. Bik, Penporn Koanantakool, Tatiana Shpeisman, Nicolas Vasilache, Bixia Zheng, and Fredrik Kjolstad. *ACM Transactions on Architecture and Code Optimization (TACO) (Accepted)*, 2022.

2. SpDISTAL: Compiling Distributed Sparse Tensor Computations. Rohan Yadav, Alex Aiken, and Fredrik Kjolstad. *ACM/IEEE International Conference for High Performance Computing, Networking, Storage and Analysis (SC)*, 2022.

3. DISTAL: The Distributed Tensor Algebra Compiler. Rohan Yadav, Alex Aiken, and Fredrik Kjolstad. *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, 2022.

4. Autoscheduling for Sparse Tensor Algebra with an Asymptotic Cost Model. Peter Ahrens, Fredrik Kjolstad, and Saman Amarasinghe. *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, 2022.

5. Copy-and-Patch Compilation. Haoran Xu and Fredrik Kjolstad. *Proceedings of the ACM on Programming Languages, Volume 5, Issue OOPSLA* (**Distinguished Paper Award**), 2021.

6. Compilation of Sparse Array Programming Models. Rawn Henry, Olivia Hsu, Rohan Yadav, Stephen Chou, Kunle Olukotun, Saman Amarasinghe, and Fredrik Kjolstad. *Proceedings of the ACM on Programming Languages, Volume 5, Issue OOPSLA*, 2021.

7. A Sparse Iteration Space Transformation Framework for Sparse Tensor Algebra. Ryan Senanayake, Changwan Hong, Ziheng Wang, Amalee Wilson, Stephen Chou, Shoaib Kamil, Saman Amarasinghe, and Fredrik Kjolstad. *Proceedings of the ACM on Programming Languages, Volume 4, Issue OOPSLA*, 2020.

8. Rick Bahr, Clark Barrett, Nikhil Bhagdikar, Alex Carsello, Ross Daly, Caleb Donovick, David Durst, Kayvon Fatahalian, Kathleen Feng, Pat Hanrahan, Teguh Hofstee, Mark Horowitz, Dillon Huff, Fredrik Kjolstad, Taeyoung Kong, Qiaoyi Liu, Makai Mann, Jackson Melchert, Ankita Nayak, Aina Niemetz, Gedeon Nyengele, Priyanka Raina, Stephen Richardson, Raj Setaluri, Jeff Setter, Kavya Sreedhar, Maxwell Strange, James Thomas, Christopher Torng, Leonard Truong, Nestan Tsiskaridze, and Keyi Zhang. Creating an Agile Hardware Design Flow. *Design Automation Conference (DAC)*, 2020.

9. Stephen Chou, Fredrik Kjolstad, and Saman Amarasinghe. Automatic Generation of Efficient Sparse Tensor Format Conversion Routines. *ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI)*, 2020.

10. Fredrik Kjolstad, Peter Ahrens, Shoaib Kamil, and Saman Amarasinghe. Sparse Tensor Algebra Optimization with Workspaces. *International Symposium on Code Generation and Optimization (CGO)*, 2019.

11. Stephen Chou, Fredrik Kjolstad, and Saman Amarasinghe. Format Abstraction for Sparse Tensor Algebra Compilers. *Proceedings of the ACM on Programming Languages, Volume 2, Issue OOPSLA*, 2018.

12. Fredrik Kjolstad, Shoaib Kamil, Stephen Chou, David Lugato, and Saman Amarasinghe. The Tensor Algebra Compiler. *Proceedings of the ACM on Programming Languages, Volume 1, Issue OOPSLA* (**Distinguished Paper Award**), 2017.

13. Fredrik Kjolstad, Shoaib Kamil Jonathan Ragan-Kelley, David I.W. Levin, Shinjiro Sueda, Desai Chen, Etienne Vouga, Danny M. Kaufman, Gurtej Kanwar, Wojciech Matusik, and Saman Amarasinghe. Simit: A Language for Physical Simulation. *ACM Transactions on Graphics (TOG, presented at SIGGRAPH)*, 2016.

14. Timo Schneider, Fredrik Kjolstad, and Torsten Hoefler. MPI Datatype Processing using Runtime Compilation. *The 20th European MPI Users' Group Meeting (EuroMPI)* (**Best Paper Award**), 2013.

15. Fredrik Kjolstad, Danny Dig, Gabriel Acevedo, and Marc Snir. Transformation for Class Immutability. *33rd International Conference on Software Engineering*, 2011.

Short Papers and Workshop Publications

16. Suzanne Mueller, Peter Ahrens, Stephen Chou, Fredrik Kjolstad, and Saman Amarasinghe. Sparse Tensor Transpositions. *ACM Symposium on Parallelism in Algorithms and Architectures (SPAA brief announcement)*, 2020.

17. David Lugato, Fredrik Kjolstad, Stephen Chou, Saman Amarasinghe, and Shoaib Kamil. Taco: compilation et génération de code d'expressions tensorielles. *AVANCÉES No. 12*, 2018.

18. Fredrik Kjolstad, Stephen Chou, David Lugato, Shoaib Kamil, and Saman Amarasinghe. 32th IEEE/ACM International Conference on Automated Software Engineering (ASE tools paper). *taco: A Tool to Generate Tensor Algebra Kernels*, 2017.

19. Gilbert Bernstein, and Fredrik Kjolstad. ACM Transactions on Graphics (TOG perspective paper). *Why New Programming Languages for Simulation?*, 2016.

20. Fredrik Kjolstad, Torsten Hoefler, and Marc Snir. Automatic Datatype Generation and Optimization. *17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP short paper)*, 2012.

21. Fredrik Kjolstad, Danny Dig, and Marc Snir. Bringing the HPC Programmer's IDE into the 21st Century through Refactoring. *SPLASH 2010 Workshop on Concurrency for the Application Programmer (CAP)*, 2010.

22. Fredrik Kjolstad and Marc Snir. Ghost Cell Pattern. *2nd Annual Workshop on Parallel Programming Patterns*, 2010.

Awards

2022 NSF CAREER Award

2021 Distinguished Paper Award at the Object-Oriented Programming, Systems, Languages & Applications Conference (OOPSLA).

2021 Google Research Scholar

2020 First Place MIT EECS George M. Sprowls PhD Thesis Award in Computer Science

2020 Robert N. Noyce Faculty Fellow, Stanford University School of Engineering

2017 Distinguished Paper Award at the Object-Oriented Programming, Systems, Languages & Applications Conference (OOPSLA).

2016 Adobe Fellowship.

2013 Best Paper Award at the 20th European MPI Users' Group Meeting (EuroMPI).

2011 Best Poster Award from the University of Illinois at Urbana-Champaign Spring Grad Expo.

2006 Rosing Award for best national IT-related student work in 2005 and 2006 from the Norwegian Computer Society.

2005 Eureka Award for best bachelor project from the Norwegian University of Science and Technology in Gjøvik.

Teaching

2020–2021 **CS343d Domain-Specific Programming Models and Compilers,** *Stanford University.*

2020–2022 **CS143 Compilers,** *Stanford University.*

Service

Program Committees
PLDI 2021, 2023
CGO 2020, 2022
PPOPP 2020, 2021, 2023
SPLASH SRC 2021
PLDI SRC 2020

External Review Committes
PLDI 2020
ASPLOS 2020

Chairs
PPoPP 2023 Publications Chair

Journal Reviews
ACM TACO 2019, 2021, 2022
ACM TOMS 2021
ACM TOPC 2020
ACM TOG 2017
IEEE TPDS 2017, 2021
Springer JPDC 2022

Organizer **Invited Workshop on Compiler Techniques for Sparse Tensor Algebra** (2019)
Invited workshop that brought together leading researchers on sparse tensor algebra compilation and computing from 11 universities, 6 companies and 3 national labs.

Third and fourth MIT Programming Languages Offsite Retreat (2012 and 2013)
Attended by seven CSAIL professors and their research groups. Re-organized program around many short talks, hosted panels, invited external speakers, and gave opening remarks.

Panels

Panelist **NSF Review Panel** (2021,2022)

Panelist **PLDI PL Mentoring Workshop** (June, 2020)

Panelist **ADA Fall Symposium panel on Agile Systems Design** (Oct. 2018)
With Julian Shun, Baris Kasikci and Sharad Malik, moderated by Zachary Tatlock.

Talks

Misc Talks

Mar. 2021 Stanford CS349e Guest Lecture on Sparse Computation and Accelerator Hardware
Dec. 2019 NSF SPX Workshop on Abstraction without Friction
Aug. 2019 NTNU TDT4200 Guest Lecture on Parallel Computing
Jun. 2019 NSF Workshop on Future Directions for Parallel and Distributed Computing Short Talk on Abstraction Without Friction
Sep. 2016 MIT 6.172 Lecture on Introduction to C
Nov. 2014 Harvard CS207 Guest Lecture on Graphs, Matrices, and Compilers

Sparse Tensor Algebra Compilation

Jun. 2021 NVIDIA
Apr. 2021 Meta PyTorch Team
Oct. 2021 IAP Workshop
Sep. 2021 Amazon Labs
Aug. 2021 AHA Retreat
Mar. 2021 Accenture Labs Distinguished Researcher Talk
Jan. 2020 SIAM PP on Sparse Tensor Algebra Compilation
Jan. 2020 SIAM PP on Sparse Tensor Algebra Optimization
Dec. 2019 Google Compilers and ML Reading Group on Tensor Algebra Compilation with Workspaces
Aug. 2019 NTNU AI Seminar, Invited Talk
Jul. 2019 MIT Fast Code Seminar, Invited Talk
May 2019 MIT Graphics Group Seminar, Invited Talk
Apr. 2019 ADA e-workshop
Apr. 2019 Cornell, Invited Seminar

Apr. 2019 Stanford, Invited Seminar
Mar. 2019 Georgia Tech CSE, Invited Seminar
Feb. 2019 International Symposium on Code Generation and Optimization (CGO), Washington DC
Feb. 2019 Innovations in Software Engineering Conference, India, Invited Talk
Jan. 2019 UT Austin ECE, Invited Seminar
Nov. 2018 Key Presentation in DARPA Review
Nov. 2018 ADA Liaison Meeting Talk
Sep. 2018 University of Texas, Austin
Sep. 2018 Semiconductor Research Corporation TECHCON, Austin
Jun. 2018 Adobe Research, Seattle
Jun. 2018 NVIDIA, Redmond
Jun. 2018 University of Washington
Jun. 2018 Facebook AI, Menlo Park
May 2018 Stanford
May 2018 UC Berkeley
May 2018 Google Brain, Mountain View
Apr. 2018 Industry-Academia Partnership MIT Cloud Workshop, Invited Talk
Mar. 2018 SIAM Parallel Processing for Scientific Computing, Tokyo, Invited Talk
Jan. 2018 SciDAC4 Kickoff Meeting, Thomas Jefferson National Accelerator Facility
Nov. 2017 University of Illinois, Urbana-Champaign
Nov. 2017 Automated Software Engineering Tools Track (ASE)
Oct. 2017 Object-Oriented Programming, Systems, Languages, and Analysis (OOPSLA)
Oct. 2017 Microsoft Research, Redmond
Apr. 2017 MIT 6.S898 Guest Lecture

Simit: A Language for Computing on Sparse Systems

Sep. 2016 Intel Research, Hudson
Aug. 2016 Microsoft Research, Redmond
Jul. 2016 ACM Special Interest Group on Graphics (SIGGRAPH)
Oct. 2015 MIT Computer Graphics Group Annual Retreat
May 2015 MIT Programming Languages Offsite

Transformation for Class Immutability

May 2011 33rd International Conference on Software Engineering
Apr. 2011 UPCRC Illinois Summit

Refactoring for High-Performance Computing

Oct. 2010 SPLASH Workshop on Concurrency for the Application Programmer

Performance Optimization of Embedded 3D Graphics Applications

Oct. 2008 ARM Developer's Conference, Santa Clara, Invited Talk

Industry and Government Experience

2007-2009 **ARM Ltd.**, *Graphics Software Engineer.*
Developed SDK Tools and OpenGL ES 1.1/2.0 3D Graphics Driver for the ARM Mali GPUs.

2006 **Accenture Technology Solutions**, *Programmer.*
Designed parts of the pension web applications for the Norwegian government.