

# Fredrik Berg Kjoelstad

*Assistant Professor, Computer Science*

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## Academic Positions

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

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## 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.

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## Publications

### Conference and Journal Publications

1. Copy-and-Patch Compilation. Haoran Xu and Fredrik Kjolstad. *Proceedings of the ACM on Programming Languages, Volume 5, Issue OOPSLA (Distinguished Paper Award)*, 2021.
2. 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.
3. 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.
4. 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.
5. 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.

6. Fredrik Kjolstad, Peter Ahrens, Shoaib Kamil, and Saman Amarasinghe. Sparse Tensor Algebra Optimization with Workspaces. *International Symposium on Code Generation and Optimization (CGO)*, 2019.
7. 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.
8. 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.
9. 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.
10. Timo Schneider, Fredrik Kjolstad, and Torsten Hoefer. MPI Datatype Processing using Runtime Compilation. *The 20th European MPI Users' Group Meeting (EuroMPI) (Best Paper Award)*, 2013.
11. 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

12. 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.
13. David Lugato, Fredrik Kjolstad, Stephen Chou, Saman Amarasinghe, and Shoaib Kamil. Taco: compilation et génération de code d'expressions tensorielles. *AVANCÉES No. 12*, 2018.
14. 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.
15. Gilbert Bernstein, and Fredrik Kjolstad. ACM Transactions on Graphics (TOG perspective paper). *Why New Programming Languages for Simulation?*, 2016.
16. Fredrik Kjolstad, Torsten Hoefer, and Marc Snir. Automatic Datatype Generation and Optimization. *17th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming (PPoPP short paper)*, 2012.
17. 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.
18. Fredrik Kjolstad and Marc Snir. Ghost Cell Pattern. *2nd Annual Workshop on Parallel Programming Patterns*, 2010.

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### 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.

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## Teaching

- Fall 2021 **CS343d Domain-Specific Programming Models and Compilers**, *Stanford University*.
- Spring 2021 **CS143 Compilers**, *Stanford University*.
- Fall 2020 **CS343d Domain-Specific Programming Models and Compilers**, *with Pat Hanrahan, Stanford University*.
- Spring 2020 **CS143 Compilers**, *Stanford University*.

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## Service

- Program Committee **PLDI 2021** Program Committee
- CGO 2020, 2022** Program Committee
- PPOPP 2020, 2021** Program Committee
- SPLASH SRC 2021** Program Committee
- PLDI 2020** External Review Committee
- ASPLOS 2020** External Review Committee
- PLDI 2020 SRC** Program Committee
- Journal Review **ACM Transactions on Mathematical Software (TOMS)** 2021
- ACM Transactions on Parallel Computing (TOPC)** 2020
- ACM Transactions on Architecture and Code Optimization (TACO)** 2019, 2021
- ACM Transactions on Graphics (TOG)** 2017
- IEEE Transactions on Parallel and Distributed Systems (TPDS)** 2017, 2021
- 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.

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## Panels

- Panelist **NSF Review Panel** (2021)

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.

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## 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

- 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

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## **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.

2005-2006 **Norwegian Army**, *Engineer*.  
Mandatory conscripted military service in the Norwegian Engineering Battalion.