# Fredrik Kjolstad

*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. Copy-and-Patch Compilation. Haoran Xu and Fredrik Kjolstad. *Proceedings of the ACM on Programming Languages, Volume 5, Issue OOPSLA*, 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 Hoefler. 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 Hoefler, 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.

## Awards

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

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

Spring 2020 **CS143 Compilers,** *Stanford University.*

## 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 Parallel Computing** (TOPC 2020)
**ACM Transactions on Architecture and Code Optimization** (TACO 2019)
**ACM Transactions on Graphics** (TOG 2017)
**IEEE Transactions on Parallel and Distributed Systems** (TPDS 2017)

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)

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

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| 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

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| 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

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| 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.

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