Kenneth L. Ho

Email: klho@alumni.caltech.edu | Phone: (510) 972-4702 | Web: http://klho.github.io

Academic and Employment History

07/2021 –	Technical Manager, Optimal Pattern Correction, TSMC, San Jose, CA
08/2017 – 06/2021	Principal Engineer, Optimal Pattern Correction, TSMC, San Jose, CA
06/2019 – 12/2020	Visiting Scholar/Consultant, CCM, Flatiron Institute, New York, NY
08/2015 – 08/2017	Sr. Engineer, Optimal Pattern Correction, TSMC, San Jose, CA
01/2013 – 07/2015	NSF Postdoctoral Fellow, Mathematics, Stanford University
09/2012 – 12/2012	Visiting Scholar, Courant Institute, NYU
08/2012	Visiting Scholar, Theoretical Systems Biology, Imperial College London
06/2012 – 08/2012	Assistant Research Scientist, Courant Institute, NYU
09/2007 – 05/2012	Ph.D., Computational Biology (Mathematics), Courant Institute, NYU
06/2010 – 02/2012	Intern/Consultant, Schrödinger, New York, NY
09/2003 – 06/2007	B.S. (with honor), Applied and Computational Mathematics, Caltech

Technical Summary

- Applied mathematics Ph.D. with broad training in computer science, statistics, biology, and chemistry
- Research expertise in fast multipole methods, fast direct solvers, structured matrices; numerical analysis, scientific computing, numerical linear algebra; computational physics, biology, and chemistry
- 6+ years industry experience in computational lithography (OPC, ILT, SMO) and software engineering
- *Computing*: C, C++, CUDA, Fortran, Julia, LaTeX, MATLAB, MPI, Octave, OpenMP, Python
- *Awards*: NSF graduate and postdoctoral fellowships (DMS-1203554), NYU dissertation award, Caltech merit award and research fellowship
- 20+ peer-reviewed publications, 4+ patents, 46 conference/seminar presentations, 8 open-source codes
- Google Scholar: 6gr2NYwAAAAJ (850+ citations); ORCID: 0000-0001-5450-4966

Major Achievements and Responsibilities

- $O(N)$ LU-like decomposition for hierarchical matrices; applications to physics and machine learning
- $O(N \log N)$ sparse "butterfly" factorization for Fourier integral operators
- Differential equation modeling in systems biology; model selection using algebraic geometry
- Open-source software for hierarchical matrix algorithms, low-rank approximation, pruned FFTs
- At TSMC: core developer of in-house lithography simulator, especially numerical methods and computational infrastructure; ILT/HPC team lead; fast vector TCC; CPU/GPU acceleration

Publications

25. K.L.K. Ho. Method and apparatus for computing feature kernels for optical model simulation. U.S. patent 11,003,092, 2021. Priority Aug. 31, 2018. Google: US11003092.
24. D. Peng, J. Lei, D. Beylkin, K.L.K. Ho, S. Trivedi, F. Xu. Synchronized parallel tile computation for large area lithography simulation. U.S. patent 10,915,090, 2021. Priority Nov. 15, 2017. US10915090.
23. K.L.K. Ho. Method and apparatus for computing feature kernels for optical model simulation. U.S. patent 10,809,629, 2020. Priority Aug. 31, 2018. Also: CN110929366, TW202011110. Google: US10809629.
22. K.L. Ho. FLAM: Fast linear algebra in MATLAB – Algorithms for hierarchical matrices. J. Open Source Softw. 5 (51): 1906, 2020. doi:10.21105/joss.01906.

21. D. Beylkin, K.L. Ho, S.V. Trivedi, F. Xu, J. Lei, D. Peng. Synchronized parallel tile computation for large area lithography simulation. U.S. patent 10,671,052, 2020. Priority Nov. 15, 2017. Also: CN109788646, TW201923442. Google: US10671052.
20. Z. Chen, J. Zhang, K.L. Ho, H. Yang. Multidimensional phase recovery and interpolative decomposition butterfly factorization. J. Comput. Phys. 412: 109427, 2020. doi:10.1016/j.jcp.2020.109427.
19. Q. Pang, K.L. Ho, H. Yang. Interpolative decomposition butterfly factorization. SIAM J. Sci. Comput. 42 (2): A1097–A1115, 2020. doi:10.1137/19M1294873.
18. J. Feliu-Fabà, K.L. Ho, L. Ying. Recursively preconditioned hierarchical interpolative factorization for elliptic partial differential equations. Commun. Math. Sci. 18 (1): 91–108, 2020. doi:10.4310/CMS.2020.v18.n1.a4.
17. H.A. Harrington, K.L. Ho, N. Meshkat. A parameter-free model comparison test using differential algebra. Complexity 2019: 6041981, 2019. doi:10.1155/2019/6041981.
16. V. Minden, A. Damle, K.L. Ho, L. Ying. Fast spatial Gaussian process maximum likelihood estimation via skeletonization factorizations. Multiscale Model. Simul. 15 (4): 1584–1611, 2017. doi:10.1137/17M1116477.
15. F. Fang, K.L. Ho, L. Ristroph, M.J. Shelley. A computational model of the flight dynamics and aerodynamics of a jellyfish-like flying machine. J. Fluid Mech. 819: 621–655, 2017. doi:10.1017/jfm.2017.150.
14. V. Minden, K.L. Ho, A. Damle, L. Ying. A recursive skeletonization factorization based on strong admissibility. Multiscale Model. Simul. 15 (2): 768–796, 2017. doi:10.1137/16M1095949.
13. E. Gross, B. Davis, K.L. Ho, D.J. Bates, H.A. Harrington. Numerical algebraic geometry for model selection and its application to the life sciences. J. R. Soc. Interface 13 (123): 20160256, 2016. doi:10.1098/rsif.2016.0256. PMID:27733697.
12. K.L. Ho, L. Ying. Hierarchical interpolative factorization for elliptic operators: differential equations. Comm. Pure Appl. Math. 69 (8): 1415–1451, 2016. doi:10.1002/cpa.21582.
11. K.L. Ho, L. Ying. Hierarchical interpolative factorization for elliptic operators: integral equations. Comm. Pure Appl. Math. 69 (7): 1314–1353, 2016. doi:10.1002/cpa.21577.
10. V. Minden, A. Damle, K.L. Ho, L. Ying. A technique for updating hierarchical skeletonization-based factorizations of integral operators. Multiscale Model. Simul. 14 (1): 42–64, 2016. doi:10.1137/15M1024500.
9. Y. Li, H. Yang, E.R. Martin, K.L. Ho, L. Ying. Butterfly factorization. Multiscale Model. Simul. 13 (2): 714–732, 2015. doi:10.1137/15M1007173.
8. K.L. Ho, L. Greengard. A fast semidirect least squares algorithm for hierarchically block separable matrices. SIAM J. Matrix Anal. Appl. 35 (2): 725–748, 2014. doi:10.1137/120902677.
7. L. Greengard, K.L. Ho, J.-Y. Lee. A fast direct solver for scattering from periodic structures with multiple material interfaces in two dimensions. J. Comput. Phys. 258: 738–751, 2014. doi:10.1016/j.jcp.2013.11.011.
6. K.L. Ho. Fast direct methods for molecular electrostatics. Ph.D. thesis, New York Univ., 2012. UMI:3524158.
5. H.A. Harrington, K.L. Ho, T. Thorne, M.P.H. Stumpf. Parameter-free model discrimination criterion based on steady-state coplanarity. Proc. Natl. Acad. Sci. U.S.A. 109 (39): 15746–15751, 2012. doi:10.1073/pnas.1117073109. PMID:22967512.
4. K.L. Ho, L. Greengard. A fast direct solver for structured linear systems by recursive skeletonization. SIAM J. Sci. Comput. 34 (5): A2507–A2532, 2012. doi:10.1137/120866683.
3. J.A. Bell, K.L. Ho, R. Farid. Significant reduction in errors associated with nonbonded contacts in protein crystal structures: automated all-atom refinement with *PrimeX*. Acta Cryst. D68 (8): 935–952, 2012. doi:10.1107/S0907444912017453. PMID:22868759.
2. K.L. Ho, H.A. Harrington. Bistability in apoptosis by receptor clustering. PLoS Comput. Biol. 6 (10): e1000956, 2010. doi:10.1371/journal.pcbi.1000956. PMID:20976242.

1. H.A. Harrington, K.L. Ho, S. Ghosh, KC Tung. Construction and analysis of a modular model of caspase activation in apoptosis. Theor. Biol. Med. Model. 5: 26, 2008. doi:10.1186/1742-4682-5-26. PMID:19077196.

Presentations

- *Conferences and workshops*: NVIDIA GTC 2020; SIAM AN18; SIAM CSE15; MBI WYRMB 2014; SIAM AN14; FACM 2014; SIAM UQ14; BIRS Workshop on Integral Equations, 2013; SIAM CSE13; NYU/ Columbia RTG Symp., NYU, 2012; SIAM LS12; SIAM AN12; SIAM ALA12; CJR, Yale, 2012; DOE Appl. Math. Prog. Meet., 2011; Courant 75th Anniv., NYU, 2011; COB Day, NYU, 2009; NSF IGERT PI Meet., 2009; Bioeng. Bootcamp, Caltech, 2008; MBI Summer Grad. Prog., 2007; RIPS-IPAM 2006; SURF Semin. Day, Caltech, 2005
- *Seminars and colloquiua*: Argonne Natl. Lab., CMU (2), Caltech, Colorado State, Imperial College London (2), JPL, LBNL, NCSU, NJIT, NYU (4), Stanford, Theranos, TSMC (2), U. Minnesota, U. Wisconsin-Madison, UC Irvine (2), UC Riverside

Codes

8. mortgage.py: a simple state-based mortgage calculator
7. f2mkl: adapter for preloading MKL in applications linked against Fortran BLAS
6. lpscheduler: a simple linear-programming-based scheduling utility
5. SparseFFT.jl: sparse fast Fourier transforms in Julia
4. LowRankApprox.jl: fast low-rank matrix approximation in Julia (doi:10.5281/zenodo.1254147)
    - original developer; now maintained by JuliaMatrices
3. FLAM: fast linear algebra in MATLAB (doi:10.5281/zenodo.1253581)
2. PyMatrixID: fast interpolative decompositions in Python
    - contributed to SciPy as scipy.linalg.interpolative
1. hypoct: hyperoctree construction and manipulation