

# Stanley Bak

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Stanley Bak is an assistant professor in the [Department of Computer Science](#) at [Stony Brook University](#) investigating the verification of **autonomy**, **cyber-physical systems**, and **neural networks**. He strives to develop practical formal methods that are both scalable and useful, which demands developing new theory, programming efficient tools and building experimental systems.

## Education

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- **Doctor of Philosophy in Computer Science** **May 2013**  
*University of Illinois at Urbana-Champaign* *Champaign, IL*  
Dissertation Title: "[Verifiable COTS-based Cyber-Physical Systems](#)"  
Advisors: [Marco Caccamo](#) and [Lui Sha](#)
- **Master of Science in Computer Science** **October 2009**  
*University of Illinois at Urbana-Champaign* *Champaign, IL*  
Thesis Title: "[Industrial Application of the System-Level Simplex Architecture for Real-Time Embedded System Safety](#)"  
Advisors: [Marco Caccamo](#) and [Lui Sha](#)
- **Bachelor of Science in Computer Science** **May 2007**  
*Rensselaer Polytechnic Institute* *Troy, NY*  
Summa Cum Laude, GPA: 3.96/4.0

## Positions

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- **Assistant Professor, Department of Computer Science** **September 2020–Present**  
*Stony Brook University* *Stony Brook, NY*  
Investigated formal verification methods for autonomy, cyber-physical systems, and neural networks. Wrote and received competitive grant proposals from government agencies and ran student research group while teaching courses at the graduate and undergraduate levels.
- **Senior Research Scientist** **April 2018–Present**  
*Safe Sky Analytics* *McLean, VA*  
Led internal research effort investigating the verification of hybrid automaton models, including proposing, managing, and technically executing grants from federal sources. Applied verification methods towards models of F-16 ground collision avoidance and space debris tracking with Air Force Research Lab personnel. Supervised summer research intern on scalable verification for deep learning (neural network) architectures.
- **Adjunct Professor** **August 2019–December 2019**  
*Georgetown University* *Washington, DC*  
Designed and taught a graduate and advanced undergraduate level course on verification methods and real-time systems. Topics included formal logic, software verification, abstract interpretation, real-time scheduling / resource sharing, model checking, temporal logic, control theory and hybrid systems verification.

- Research Computer Scientist** **August 2013–March 2018**  
 ○ *United States Air Force Research Laboratory (AFRL)* *Dayton, OH / Rome, NY*

Principle Investigator on two 3-year internal research efforts (\$1.4 million) on formal analysis methods for the analysis of CPS, tailored at security issues and verification of autonomous systems. Initiated and coordinated AFRL funding of over \$600K of external academic research. Started Verification & Validation Reading Group within the Aerospace System Autonomous Control Branch and mentored junior researchers.
- Graduate Research Assistant** **August 2007–May 2013**  
 ○ *University of Illinois at Urbana-Champaign* *Champaign, IL*

Lead research assistant on three-year grant from John Deere investigating verification architectures for off-road agricultural vehicles. Presented results to John Deere CEO in Kaiserslautern, Germany. Encoded VHDL Formal Semantics in the Maude rewriting logic framework to enable formal verification and worst-case execution time analysis. Started Real-Time Systems Security Reading Group for graduate students.
- Summer Research Intern** **2010, 2011, 2012**  
 ○ *United States Air Force Research Laboratory (AFRL)* *Rome, NY*

Devised a hardware-based coarse-grained security tagged architecture for information-flow security in system-on-chip designs. Implemented prototype on an FPGA and work was accepted for publication.
- Summer Research Intern** **2007**  
 ○ *Indian Head Naval Surface Warfare Center (NSWC)* *Indian Head, MD*

Wrote sensor software in LabVIEW to measure and analyze detonation forces of experimental energetics. Taught STEM camp for middle school students using Lego Mindstorm Robots.
- Undergraduate Research Assistant** **June 2004–May 2007**  
 ○ *Rensselaer Polytechnic Institute* *Troy, NY*

Performed three undergraduate research projects in Mathematics, Robotics, and Formal Logic. Completed two journal publications from Mathematics research and was awarded RPI's Founders' Award of Excellence.

## Teaching

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### Stony Brook University

- (Fall 2021) CSE 510, Hybrid Systems, overall grade A (80%), [full report](#). Student Comment: *"The subject matter was extremely interesting and something I didn't have any experience with before taking this course. The project really helped me clarify my understanding of reachability analysis and the homework were a lot of fun. This is the first class in awhile that I've sent pictures of the homework results to my friends."*
- (Fall 2021) CSE 643, CPS and Verification Seminar, overall grade A (75%), [full report](#)
- (Spring 2021) CSE 510, Hybrid Systems, overall grade A (100%), [full report](#). Student Comment: *"Professor Bak's approach is very effective with examples and work from real life implementation. The guest lectures were just the cherry on top, and the course was well structured to ease in the new concepts. The discussions during in class assignments helped a lot with critical understanding."*

### Georgetown University

- (Fall 2019) COSC-560, Real-Time Systems and Temporal Verification

## Grants and Fellowships

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- (2022) “Scalable Verification of Autonomous Systems using Gray-Box Reachability”, Office of Naval Research (Sole PI), \$350K
- (2021) “Verifying Sensor-Noise Robustness of Reinforcement Learning”, SUNY / AFRL Trusted AI Challenge Series (Co-PI with Amir Rahmati), \$100K
- (2020) “The Science of Fuzz Testing Autonomous Cyber-Physical Systems”, AFOSR 2020 Young investigator Research Program (YIP) Award (Sole PI), \$450K
- (2019) “Enhanced Testing of Autonomous Systems using Formal Methods”, AFOSR Grant under BAA-AFOSR-2019 Agile Science of Test and Evaluation (Co-PI), \$540K
- (2019) “Verification and Validation of Autonomy”, subcontract to Infoscitex Corporation under prime contract FA865015D2516 (PI), \$136K
- (2018) “Verification and Validation / Hybrid Systems Reachability”, subcontract to Wright Brothers Institute under prime contract FA86501237255. (PI), \$106K
- (2016) “Agile Approaches for Correct Design of Cyber-Physical Systems”, AFOSR LRIR Award under BAA-AFOSR-2016 Systems and Software (Co-PI), \$739K
- (2013) “Perpetual Model Validation”, AFOSR LRIR Award under BAA-AFOSR-2013 Systems and Software (Co-PI), \$739K
- (2009) Science, Mathematics and Research for Transformation (SMART) Scholarship, \$335K
- (2008) Debra and Ira Cohen Graduate Fellowship, Stipend (\$22K) + Tuition Waiver (\$38K) = \$60K
- (2007) Debra and Ira Cohen Graduate Fellowship, Stipend (\$21K) + Tuition Waiver (\$37K) = \$58K

## Awards

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- (2022) Research Excellence Award from Stony Brook CS Department
- (2021) 2021 Air Force Research Lab Summer Faculty Fellowship Program (SFFP) at AFRL Information Directorate
- (2017) €500 Best Paper Award at ARCH Workshop
- (2016) \$2000 Aerospace Systems Directorate International Award
- (2016) \$400 Best Repeatability Evaluation Package Award at HSCC
- (2016) €500 Best Tool Award at ARCH Workshop
- (2013) Nexus 10 Tablet Winner in Coyote Logistics Hackathon (1st Place)
- (2013) \$100 Amazon Gift Card Winner in UIUC indeed.com Programming Competition
- (2011) \$50 Amazon Gift Card Winner in UIUC indeed.com Programming Competition
- (2010) iPod Touch Winner in UIUC ICPC Programming Competition (1st Place)
- (2007) Connect-4 Artificial Intelligence Class Champion (1st Place, Also Beat Multiyear Champion)
- (2004) Founders Award of Excellence for Undergraduate Research
- (2004) Winner in RPI Programming Contest (1st Place)

## Program Committees

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- (EMSOFT 2022) 22nd ACM SIGBED International Conference on Embedded Software

- (NFM 2022) 14th NASA Formal Methods Symposium
- (ICCPS-RE 2022) 13th ACM/IEEE International Conference on Cyber-Physical Systems, Repeatability Evaluation Co-Chair
- (HSCC 2022) 25th ACM International Conference on Hybrid Systems: Computation and Control
- (HSCC-RE 2022) 25th ACM International Conference on Hybrid Systems: Computation and Control, Repeatability Evaluation Co-Chair
- (ARCH 2022) 9th International Workshop on Applied Verification of Continuous and Hybrid Systems
- (RTSS 2021) 42nd IEEE Real-Time Systems Symposium
- (ARCH 2021) 8th International Workshop on Applied Verification of Continuous and Hybrid Systems
- (ATVA 2021) 19th International Symposium on Automated Technology for Verification and Analysis
- (EMSOFT 2021) 21st ACM SIGBED International Conference on Embedded Software
- (ICCPS 2021) 12th ACM/IEEE International Conference on Cyber-Physical Systems
- (HSCC-RE 2021) 24th ACM International Conference on Hybrid Systems: Computation and Control, Repeatability Evaluation Co-Chair
- (HSCC 2021) 24th ACM International Conference on Hybrid Systems: Computation and Control
- (EMSOFT 2020) 20th ACM SIGBED International Conference on Embedded Software
- (ARCH 2020) 7th International Workshop on Applied Verification of Continuous and Hybrid Systems
- (NSV 2020) 13th International Workshop on Numerical Software Verification
- (ICCPS 2020) 11th ACM/IEEE International Conference on Cyber-Physical Systems
- (HSCC 2019) 22nd ACM International Conference on Hybrid Systems: Computation and Control
- (CyPhy 2019) 9th Workshop on Design, Modeling and Evaluation of Cyber Physical Systems
- (DARS 2019) 4th Workshop on Design and Analysis of Robust Systems
- (EMSOFT 2019) 19th ACM SIGBED International Conference on Embedded Software
- (ARCH 2019) 6th International Workshop on Applied Verification of Continuous and Hybrid Systems
- (ICCPS 2019) 10th ACM/IEEE International Conference on Cyber-Physical Systems
- (CyPhy 2018) 8th Workshop on Design, Modeling and Evaluation of Cyber Physical Systems
- (ARCH 2018) 5th International Workshop on Applied verification for Continuous and Hybrid Systems
- (HSCC 2018) 21st ACM International Conference on Hybrid Systems: Computation and Control
- (ICCPS 2018) 9th ACM/IEEE International Conference on Cyber-Physical Systems
- (DARS 2018) 3rd Workshop on Design and Analysis of Robust Systems
- (SNR 2018) 4th International Workshop on Symbolic and Numerical Methods for Reachability Analysis
- (RTEST WiP 2018) CSI International Symposium on Real-Time and Embedded Systems and Technologies, Work-in-Progress Session
- (RTSS-AE 2017) 38th IEEE Real-Time Systems Symposium, Artifact Evaluation Chair
- (S5 2017) 8th Annual Safe and Secure Systems and Software Symposium
- (NSV 2017) 10th International Workshop on Numerical Software Verification
- (SNR 2017) 3rd International Workshop on Symbolic and Numerical Methods for Reachability Analysis
- (HSCC-RE 2017) 20th ACM International Conference on Hybrid Systems: Computation and Control, Repeatability Evaluation

- (ARCH 2017) 4th International Workshop on Applied veRification for Continuous and Hybrid Systems
- (IET CPS 2017) IET Cyber-Physical Systems: Theory and Applications, Guest Editor
- (CDCAS 2016) AAAI 2016 Fall Symposium: Cross-Disciplinary Challenges for Autonomous Systems
- (NSV 2016) 9th International Workshop on Numerical Software Verification
- (S5 2016) 7th Annual Safe and Secure Systems and Software Symposium
- (ARCH 2016) 3rd International Workshop on Applied veRification for Continuous and Hybrid Systems
- (RTAS 2016) 22nd IEEE Real-Time Embedded Technology and Applications Symposium, Embedded Systems Design for Real-Time Applications Track
- (ICCPs-WiP 2016) 7th ACM/IEEE International Conference on Cyber-Physical Systems, Work-in-Progress/Demo/Poster Session
- (RTSS 2015) 36th IEEE Real-Time Systems Symposium, Cyber-Physical Systems Track
- (RTSS-WiP 2015) 36th IEEE Real-Time Systems Symposium, Work-in-Progress Session
- (S5 2015) 6th Annual Safe and Secure Systems and Software Symposium
- (ARCH 2015) 2nd International Workshop on Applied veRification for Continuous and Hybrid Systems
- (CyPhy 2014) 4th Workshop on Design, Modeling and Evaluation of Cyber Physical Systems

## Publications

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**Publication Metrics:** According to [Google Scholar](#), Stanley Bak has 2673 citations and an h-index 28 as of March 15, 2023.

### Peer-Reviewed (Refereed) Conference Papers.....

- (C90) "Conformant Synthesis for Koopman Operator Linearized Control Systems", N. Kochdumper and S. Bak, 61st IEEE Conference on Decision and Control (CDC 2022)
- (C89) "Reachability of Koopman Linearized Systems Using Random Fourier Feature Observables and Polynomial Zonotope Refinement", S. Bak, S. Bogomolov, B. Hency, N. Kochdumper, E. Lew and K. Potomkin, 34th International Conference on Computer-Aided Verification (CAV 2022), 26% acceptance rate
- (C88) "Stress Testing Autonomous Racing Overtake Maneuvers with RRT", S. Bak, J. Betz, A. Chawla, H. Zheng and R. Mangharam, 33rd IEEE Intelligent Vehicles Symposium (IV 2022), 43% acceptance rate
- (C87) "On the Coarse Robustness of Classifiers", I. Alkhouri, A. Velasquez, S. Bak and G. Atia, 56th Asilomar Conference on Signals, Systems, and Computers (ASILOMAR 2022)
- (C86) "Coverage-Guided Fuzz Testing for Cyber-Physical Systems", S. Sheikhi, E. Kim, P. S. Duggirala, S. Bak, 13th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPs 2022), 28% acceptance rate
- (C85) "The Black-Box Simplex Architecture for Runtime Assurance of Autonomous CPS", U. Mehmood, S. Sheikhi, S. Bak, S. Smolka and S. Stoller, 14th NASA Formal Methods Symposium (NFM 2022), 33% acceptance rate
- (C84) "Neural Network Compression of ACAS Xu Early Prototype is Unsafe: Closed-Loop Verification through Quantized State Backreachability", S. Bak and H. D. Tran, 14th NASA Formal Methods Symposium (NFM 2022), 33% acceptance rate
- (C83) "Robustness Verification of Semantic Segmentation Neural Networks using Relaxed Reachability", H. D. Tran, N. Pal, P. Musau, X. Yang, N. Hamilton, D. M. Lopez, S. Bak and T. T. Johnson, 33rd International Conference on Computer-Aided Verification (CAV 2021), 27% acceptance rate

- (C82) “Automatic Dynamic Parallelotope Bundles for Reachability Analysis of Nonlinear Systems”, E. Kim, S. Bak and P. S. Duggirala, 18th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS 2021), 42% acceptance rate
- (C81) “Reachability of Black-Box Nonlinear Systems after Koopman Operator Linearization”, S. Bak, S. Bogomolov, P. S. Duggirala, A. Gerlach, and K. Potomkin, IFAC Conference on Analysis and Design of Hybrid Systems (ADHS 2021)
- (C80) “nenum: Verification of ReLU Neural Networks with Optimized Abstraction Refinement”, S. Bak, 13th NASA Formal Methods Symposium (NFM 2021), 36% acceptance rate
- (C79) “Verification of Neural Network Compression of ACAS Xu Lookup Tables with Star Set Reachability”, D. Lopez, T. T. Johnson; H.D. Tran, S. Bak, X. Chen, and K. Hobbs, AIAA Scitech Forum (SCITECH 2021)
- (C78) “Reachability Analysis of Nonlinear Systems Using Hybridization and Dynamics Scaling”, D. Li, S. Bak, and S. Bogomolov, 18th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS 2020)
- (C77) “Improved Geometric Path Enumeration for Verifying ReLU Neural Networks”, S. Bak, H.D Tran, K. Hobbs and T. T. Johnson, 32nd International Conference on Computer-Aided Verification (CAV 2020), 27% acceptance rate
- (C76) “Verification of Deep Convolutional Neural Networks Using ImageStars”, H.D Tran, S. Bak, W. Xiang and T. T. Johnson, 32nd International Conference on Computer-Aided Verification (CAV 2020), 27% acceptance rate
- (C75) “NNV: The Neural Network Verification Tool for Deep Neural Networks and Learning-Enabled Cyber-Physical Systems”, H.D Tran, X. Yang, D. M. Lopez, P. Masau, L. V. Nguyen, W. Xiang, S. Bak and T. T. Johnson, 32nd International Conference on Computer-Aided Verification (CAV 2020), 27% acceptance rate
- (C74) “Aggregation Strategies in Reachable Set Computation of Hybrid Systems”, P. Duggirala and S. Bak, 16th ACM SIGBED International Conference on Embedded Software (EMSOFT 2019), 26% acceptance rate, published in special issue of ACM Transactions on Embedded Computing Systems (ACM TECS)
- (C73) “Numerical Verification of Affine Systems with up to a Billion Dimensions”, S. Bak, H. D. Tran, and T. T. Johnson, 22nd International Conference on Hybrid Systems: Computation and Control (HSCC 2019), 25% full paper acceptance rate
- (C72) “t-Barrier Certificates: A Continuous Analogy to k-Induction”, S. Bak, IFAC Conference on Analysis and Design of Hybrid Systems (ADHS 2018), 69% acceptance rate
- (C71) “Reachability Analysis for One Dimensional Linear Parabolic Equations”, H. D. Tran, W. Xiang, S. Bak, T. Johnson, IFAC Conference on Analysis and Design of Hybrid Systems (ADHS 2018), 69% acceptance rate
- (C70) “Time-Triggered Conversion of Guards for Reachability Analysis of Hybrid Automata”, S. Bak, S. Bogomolov, M. Althoff, 15th International Conference on Formal Modelling and Analysis of Timed Systems (FORMATS 2017), 58% acceptance rate
- (C69) “Simulation-Equivalent Reachability of Large Linear Systems with Inputs”, S. Bak, P. Duggirala, 29th International Conference on Computer-Aided Verification (CAV 2017), 32% acceptance rate
- (C68) “Rigorous Simulation-Based Analysis of Linear Hybrid Systems”, S. Bak, P. Duggirala, 23rd International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS 2017), 28% acceptance rate
- (C67) “HyLAA: A Tool for Computing Simulation-Equivalent Reachability for Linear Systems”, S. Bak, P. Duggirala, 20th International Conference on Hybrid Systems: Computation and Control (HSCC 2017), 38% acceptance rate



- (C66) "Verifying Cyber-Physical Systems by Combining Software Model Checking with Hybrid Systems Reachability", S. Bak, S. Chaki, 13th ACM SIGBED International Conference on Embedded Software (EMSOFT 2016), 26% acceptance rate
- (C65) "Reset-Based Recovery for Real-Time Cyber-Physical Systems with Temporal Safety Constraints", F. Abdi, R. Mancuso, S. Bak, O. Dantsker, M. Caccamo, 21st IEEE International Conference on Emerging Technology & Factory Automation (ETFA 2016)
- (C64) "Scalable Static Hybridization Methods for Analysis of Nonlinear Systems", S. Bak, S. Bogomolov, T. Henzinger, T. Johnson, P. Prakash, 19th International Conference on Hybrid Systems: Computation and Control (HSCC 2016), 49% acceptance rate, **Best Repeatability Evaluation Package Award**
- (C63) "Periodically-Scheduled Controller Analysis using Hybrid Systems Reachability and Continuization", S. Bak, T. Johnson, 36th IEEE Real-Time Systems Symposium (RTSS 2015), 22.5% conference acceptance rate (16.7% CPS track acceptance rate)
- (C62) "HYST: A Source Transformation and Translation Tool for Hybrid Automaton Models", S. Bak, S. Bogomolov, T. Johnson, ACM/IEEE 18th International Conference on Hybrid Systems: Computation and Control (HSCC 2015), 39% acceptance rate
- (C61) "Cyber-Physical Specification Mismatch Identification with Dynamic Analysis", T. Johnson, S. Bak, S. Drager, 6th ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2015), 27% acceptance rate
- (C60) "A Generalized Model for Preventing Information Leakage in Hard Real-Time Systems", R. Pellizzoni, N. Paryab, M.K. Yoon, S. Bak, S. Mohan, R. Bobba, 21st IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2015), 22% acceptance rate,
- (C59) "Real-Time Reachability for Verified Simplex Design", S. Bak, T. Johnson, M. Caccamo, L. Sha, 35th IEEE Real-Time Systems Symposium (RTSS 2014), 21% acceptance rate
- (C58) "Using Run-Time Checking to Provide Safety and Progress for Distributed Cyber-Physical Systems", S. Bak, F. Abdi, Z. Huang, M. Caccamo, Proceedings of the IEEE conference on Embedded and Real-Time Computing Systems and Applications (RTCSA 2013), 30% acceptance rate
- (C57) "On-Chip Control Flow Integrity Check for Real Time Embedded Systems", F. Abdi, J. Van Der Woude, Y. Lu, S. Bak, M. Caccamo, L. Sha, R. Mancuso, S. Mohan, Proceedings of the IEEE International Conference on Cyber-Physical Systems, Networks, and Applications (CPSNA 2013)
- (C56) "S3A: Secure System Simplex Architecture for Enhanced Security and Robustness of Cyber-Physical Systems", S. Mohan, S. Bak, E. Betti, H. Yun, L. Sha, M. Caccamo, Proceedings of the 2nd ACM International Conference on High Confidence Networked Systems (HiCoNS 2013), 57% acceptance rate
- (C55) "Memory-Aware Scheduling of Multicore Task Sets for Real-Time Systems", S. Bak, G. Yao, R. Pellizzoni, M. Caccamo, 18th IEEE International Conference on Embedded and Real-Time Computing Systems and Applications (RTCSA 2012), 48% acceptance rate
- (C54) "Sandboxing Controllers for Cyber-Physical Systems", S. Bak, K. Manamcheri, S. Mitra, M. Caccamo, 2nd ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS 2011), 25% acceptance rate
- (C53) "A Predictable Execution Model for COTS-based Embedded Systems", R. Pellizzoni, E. Betti, S. Bak, G. Yao, J. Criswell, M. Caccamo, R. Kegley, 17th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2011), 21% acceptance rate
- (C52) "Design, Implementation, and Evaluation of Covert Channel Attacks", H. Okhravi, S. Bak, S. T. King, 10th IEEE International Conference on Technologies for Homeland Security (HST 2010)
- (C51) "Hybrid Cyberphysical System Verification With Simplex Using Discrete Abstractions", S. Bak, A. Greer, S. Mitra, 16th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2010), 22% acceptance rate, **Nominated for Best Paper Award**
- (C50) "Real-Time Control of I/O COTS Peripherals for Embedded Systems", S. Bak, E. Betti, R. Pellizzoni,

M. Caccamo, L. Sha, 30th IEEE Real-Time Systems Symposium (RTSS 2009), 22% acceptance rate

- (C49) “The System-Level Simplex Architecture for Improved Real-Time Embedded System Safety”, S. Bak, D. Chivukula, O. Adegunle, M. Sun, M. Caccamo, L. Sha, 15th IEEE Real-Time and Embedded Technology and Applications Symposium (RTAS 2009), 26% acceptance rate

### Peer-Reviewed Journal Articles.....

- (J48) “Evaluation of Neural Network Verification Methods for Air-to-Air Collision Avoidance”, L. Manzanar Lopez, T. T. Johnson, S. Bak, H. D. Tran and K. Hobbs , Journal of Air Transportation (JAT 2022)
- (J47) “Verification of Piecewise Deep Neural Networks: A Star Set Approach with Zonotope Pre-Filter”, H. D. Tran, N. Pal, D. Lopez, P. Musau, X. Yang, L. Nguyen, W. Xiang, S. Bak, and T. T. Johnson, Formal Aspects of Computing (FAC 2021)
- (J46) “Hybrid Automata: From Verification to Implementation”, S. Bak, O. A. Beg, S. Bogomolov, T. T. Johnson, L. V. Nguyen, C. Schilling, International Journal on Software Tools for Technology Transfer (STTT 2019)
- (J45) “Cyber-Physical Specification Mismatches”, L. V. Nguyen, K. Hoque, S. Bak, S. Drager and T. T. Johnson, ACM Transactions on Cyber-Physical Systems (TCPS 2018)
- (J44) “A Comparison of Approaches for Finding Minimum Identifying Codes on Graphs”, V. Horan, S. Adachi, S. Bak, Quantum Information Processing (QIP 2016)
- (J43) “Real-Time Reachability for Verified Simplex Design”, T. Johnson, S. Bak, M. Caccamo, L. Sha, ACM Transactions on Embedded Computing Systems (ACM TECS 2016)
- (J42) “Global Real-Time Memory-Centric Scheduling for Multicore Systems”, G. Yao, R. Pellizzoni, S. Bak, H. Yun, M. Caccamo, IEEE Transactions on Computers (IEEE TC 2016)
- (J41) “Safety and Progress for Distributed Cyber-Physical Systems with Unreliable Communication”, S. Bak, F. Abdi, Z. Huang, M. Caccamo, ACM Transactions on Embedded Computing Systems (ACM TECS 2015)
- (J40) “Real-Time I/O Management System with COTS Peripherals”, E. Betti, S. Bak, R. Pellizzoni, M. Caccamo, L. Sha, IEEE Transactions on Computers (IEEE TC 2013)
- (J39) “Memory-Centric Scheduling for Multicore Hard Real-Time Systems”, G. Yao, R. Pellizzoni, S. Bak, E. Betti, M. Caccamo, Real-Time Systems Journal (RTSJ 2012)
- (J38) “A Third Order Accurate Fast Marching Method for the Eikonal Equation in Two Dimensions”, S. Ahmed, S. Bak, J. McLaughlin, D. Renzi, SIAM Journal on Scientific Computing (SIAM JSC 2011)
- (J37) “Some Improvements for the Fast Sweeping Method”, S. Bak, J. McLaughlin, D. Renzi, SIAM Journal on Scientific Computing (SIAM JSC 2010)

### Workshop Papers / Posters / Other.....

- (O36) “CPS Testing using Stateless RRT”, A. Chawla and S. Bak, 13th ACM/IEEE International Conference on Cyber-Physical Systems (Work-in-Progress Session) (ICCPS 2022)
- (O35) “The Second International Verification of Neural Networks Competition (VNN-COMP 2021): Summary and Results”, S. Bak, C. Liu, and T. T. Johnson, 4th Workshop on Formal Methods for ML-Enabled Autonomous Systems (FoMLAS) (VNNCOMP 2021)
- (O34) “Safe CPS from Unsafe Controllers”, U. Mehmood, S. Bak, S. Smolka and S. Stoller, Computation-Aware Algorithmic Design for Cyber-Physical Systems (CAADCPS 2021)
- (O33) “Safety-Critical Neural Networks”, S. Bak, ACM SIGBED (blog 2020)
- (O32) “ARCH-COMP20 Category Report: Continuous and Hybrid Systems with Linear Continuous



- Dynamics", M. Althoff, S. Bak, Z. Bao, M. Forets, G. Frehse, D. Freire, N. Kochdumper, Y. Li, s. Mitra, R. Ray, and C. Schilling, 7th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2020)
- (O31) "Execution-Guided Overapproximation (EGO) for Improving Scalability of Neural Network Verification", S. Bak, 3rd International Workshop on Verification of Neural Networks (VNN 2020)
  - (O30) "Demo: The Neural Network Verification (NNV) Tool", H. D. Tran, D. M. Lopez, X. Yang, P. Musau, L. V. Nguyen, W. Xiang, S. Bak, T. T. Johnson, Design Automation for CPS and IoT (DESTION 2020)
  - (O29) "ARCH-COMP19 Category Report: Continuous and Hybrid Systems with Linear Continuous Dynamics", M. Althoff, S. Bak, M. Forets, G. Frehse, N. Kochdumper, R. Ray, C. Schilling, S. Schupp, 6th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2019)
  - (O28) "Efficient n-to-n Collision Detection for Space Debris using 4D AABB Trees", S. Bak, K. Hobbs, 6th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2019)
  - (O27) "HyLAA 2.0: A Verification Tool for Linear Hybrid Automaton Models of Cyber-Physical Systems", S. Bak, P. Duggirala, Poster Session, 39th IEEE Real-Time Systems Symposium (RTSS 2018)
  - (O26) "Numerical Verification of 10000-dimensional Linear Systems 10000x Faster", S. Bak, 5th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2018)
  - (O25) "Verification Challenges in F-16 Ground Collision Avoidance and Other Automated Maneuvers", P. Heidlauf, A. Collins, M. Bolender, S. Bak, 5th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2018)
  - (O24) "Space Debris Collision Detection using Reachability", K. Hobbs, P. Heidlauf, A. Collins, S. Bak, 5th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2018)
  - (O23) "ARCH-COMP18 Category Report: Continuous and Hybrid Systems with Linear Continuous Dynamics", M. Althoff, S. Bak, X. Chen, C. Fan, M. Forets, G. Frehse, N. Kochdumper, Y. Li, S. Mitra, R. Ray, C. Schilling, S. Schupp, 5th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2018)
  - (O22) "Formal Verification of CPS using Flow-Pipe Construction of Hybrid Automata", S. Bak, Halmstad Summer School on Cyber-Physical Systems (HSSCPS 2017), Invited Instructor
  - (O21) "Challenges and Tool Implementation of Hybrid Rapidly-Exploring Random Trees", S. Bak, S. Bogomolov, T. Henzinger, A. Kumar, 10th International Workshop on Numerical Software Verification (NSV 2017)
  - (O20) "Direct Verification of Linear Systems with over 10000 Dimensions", S. Bak, P. Duggirala, 4th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2017), 83% acceptance rate, **Best Paper Award**
  - (O19) "ARCH-COMP17 Category Report: Continuous and Hybrid Systems with Linear Continuous Dynamics", M. Althoff, S. Bak, D. Cattaruzza, X. Chen, G. Frehse, R. Ray, S. Schupp, 4th International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2017)
  - (O18) "HyLAA: A Tool For Computing Simulation-Equivalent Reachability of Linear Systems", P. Duggirala, S. Bak, Demo and Poster Session, ACM/IEEE 19th International Conference on Hybrid Systems: Computation and Control (HSCC 2017)
  - (O17) "Tutorial: Software Tools for Hybrid Systems Verification, Transformation, and Synthesis: C2E2, HyST, and TuLiP", P. Duggirala, C. Fan, M. Potok, B. Qi, S. Mitra, M. Viswanathan, S. Bak, S. Bogomolov, T. T. Johnson, L. V. Nguyen, C. Schilling, A. Sogokon, H. D. Tran, W. Xiang, S. Dathathri, I. Filippidis, S. C. Livingston, R. M. Murray, N. Ozay, C. Schilling, IEEE Multi-Conference on Systems and Control (MSC 2016)
  - (O16) "Model Generation for Hybrid Systems Verification in HYST", S. Bak, S. Bogomolov, T. Johnson,

7th Annual Safe and Secure Systems and Software Symposium (S5 2016)

- (O15) “High-level Hybrid Systems Analysis with Hypy”, S. Bak, S. Bogomolov, C. Schiling, 3rd International Workshop on Applied Verification for Continuous and Hybrid Systems (ARCH 2016) **Best Tool Award**
- (O14) “Hybrid Systems Model Transformations with HyST”, S. Bak, S. Bogomolov, T. Johnson, Demo and Poster Session, ACM/IEEE 19th International Conference on Hybrid Systems: Computation and Control (HSCC 2016)
- (O13) “HYST: A Source-to-Source Transformation Framework for Hybrid Automata”, S. Bak, S. Bogomolov, T. Johnson, 1st International Workshop Symbolic and Numerical Methods for Reachability Analysis (SNR 2015)
- (O12) “Hybrid Systems Analysis of Periodic Control Systems using Continuization”, S. Bak, 6th Annual Safe and Secure Systems and Software Symposium (S5 2015)
- (O11) “Benchmark Generator for Stratified Controllers of Tank Networks”, S. Bak, S. Bogomolov, M. Greitschus, T. Johnson, Applied Verification for Continuous and Hybrid Systems (ARCH 2015)
- (O10) “Reducing the Wrapping Effect in Flowpipe Construction using Pseudo-Invariants”, S. Bak, Fourth Workshop on Design, Modeling and Evaluation of Cyber Physical Systems (CyPhy 2014)
- (O9) “Verifiable COTS-based Cyber-physical Systems”, S. Bak, PhD Dissertation (UIUC 2013)
- (O8) “Hardware Control Flow Protection for Cyber-Physical Systems”, S. Bak, Work-in-Progress, 2nd ACM International Conference on High Confidence Networked Systems (HiCoNS 2013)
- (O7) “Computing Reachability for Nonlinear Systems with HyCreate”, S. Bak, M. Caccamo, Demo and Poster Session, ACM/IEEE 16th International Conference on Hybrid Systems: Computation and Control (HSCC 2013)
- (O6) “Integrated Security for System-on-Chip Architectures”, S. Bak, J. Heiner, 7th International Workshop on Unique Chips and Systems (UCAS 2012)
- (O5) “Large-Scale Network Simulation Scalability and an FPGA-based Network Simulator”, S. Bak, Technical Report (UIUC 2012)
- (O4) “Achieving Predictable Execution in COTS-based Embedded Systems”, S. Bak, R. Pellizzoni, E. Betti, G. Yao, J. Criswell, M. Caccamo, R. Kegley, Invited Talk, 2nd Workshop on Time ORiented Reliable Embedded NeTworked Systems (TORRENTS 2011)
- (O3) “A Step Towards Verification and Synthesis from Simulink/Stateflow models”, K. Manamcheri, S. Mitra, S. Bak, M. Caccamo, Poster, Proceedings of the 14th International Conference on Hybrid Systems: Computation and Control (HSCC 2011)
- (O2) “Predictable Execution Model: Concept and Implementation”, R. Pellizzoni, E. Betti, S. Bak, G. Yao, J. Criswell, M. Caccamo, Technical Report (UIUC 2010)
- (O1) “Industrial Application of the System-Level Simplex Architecture for Real-Time Embedded System Safety”, S. Bak, Master’s Thesis (UIUC 2009)

## On-Campus Service / Affiliations

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- Mentor for Simons Summer Program for High School Student at Stony Brook University (June 2022)
- Member of SBU AI Institute (led by Prof. Steven Skiena) (Since November 2021)
- Member of the Diversity Committee (led by Prof. Aruna Balasubramanian) to increase participation of women and underrepresented groups in CS. (Since April 2021)
- Member of the Admission Committee (led by Prof. Himanshu Gupta) to review applications of MS and PhD students to Stony Brook University. (Since February 2021)
- Assisted with academic job search support for graduating Stony Brook University PhD students by providing resources to Prof. Niranjana Balasubramanian. (August 2020)

## Professional Service

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- Organizing Committee Member for the 3rd International Neural Network Verification Competition (VN-NCOMP 2022); Co-Chair
- Session Co-Chair (Symbolic Analysis) for NASA Formal Methods (NFM 2022)
- Session Co-Chair (Tools and Case Studies) for Hybrid Systems Computation and Control (HSCC 2022)
- Organizing Committee Member for International Conference on Cyber-Physical Systems (ICCPS 2022); Repeatability Evaluation Co-Chair
- Organizing Committee Member for Hybrid Systems Computation and Control (HSCC 2022); Repeatability Evaluation Co-Chair, Awards Committee Member
- ACM SIGBED Officer – Blog Editor (2021-2022)
- Session Co-Chair (Hybrid Systems) for 7th IFAC Conference on Analysis and Design of Hybrid Systems (ADHS 2021)
- NSF Panel Member for Formal Methods in the Field (FMitF) (2021)
- Organizing Committee Member for Hybrid Systems Computation and Control (HSCC 2021); Repeatability Evaluation Co-Chair
- Organizing Committee Member for the 2nd International Neural Network Verification Competition (VN-NCOMP 2021); Co-Chair
- Editorial Board Member, Journal on Systems Research (JSys), Real-Time and Cyber-Physical Systems Track (Jan 2021)
- ACM SIGBED blog regular contributor (since July 2020): <https://sigbed.org/blog/>

## Invited Talks

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- June 16, 2022, “Exhaustive Analysis to Prove Safety of Closed-Loop AI Systems”, AI in Aviation Standard Committee (SAE G-34/EUROCAE WG-114) Tech Talk, online, invited by Huafeng Yu
- May 10, 2022, “Verifying Sensor-Noise Robustness of Reinforcement Learning”, AFRL Trusted AI Challenge Series Presentations, Rome, NY, Invited by Joe Turczyn
- April 29, 2022, “Proving Safety of Closed-Loop Systems with Neural Network Controllers using Quantized State Backreachability”, Air Force Research Lab (AFRL) Autonomous Capability Team (ACT3) Invited Lecture, Dayton, OH, Invited by Kerianne Hobbs
- April 28, 2022, “Proving Safety of Closed-Loop Systems with Neural Network Controllers using Quantized State Backreachability”, University of Dayton Invited Lecture, Dayton, OH, invited by Xin Chen
- December 2, 2021, “How Good are Current Neural Network Formal Verification Methods?”, AI in Aviation (SAE G-34/EUROCAE WG-114) Standard Committee (SAE G-34) Tech Talk, online, invited by Huafeng Yu
- December 1, 2021, “Formal Verification of Neural Networks: State of the Art and Research Directions”. University of Illinois at Urbana-Champaign (UIUC) Software Seminar, online, invited by Prof. Gagandeep Singh
- November 1, 2021, “What can we prove about neural networks?”, AI Institute Seminar at Stony Brook University, online, invited by Prof. Steven Skiena
- October 18, 2021, Invited Panelist on Neural Network Verification Methods, ATVA 2021 Workshop on Security and Reliability of Machine Learning (SRL), online, invited by Shiqi Wang
- August, 23, 2021, “Symbolic and Numeric Challenges in Neural Network Verification Methods”, Symbolic-Numeric methods for Reasoning about CPS and IoT (SNR), 2021, online, invited by Prof. Hoang-Dung Tran
- July 18, 2021, “Formal Verification for Neural Networks and Cyber-Physical Systems with Reachability Methods”, 14th International Workshop on Numerical Software Verification (NSV) 2021, online, invited by Prof. Chuchu Fan
- March 30, 2021, “Formal Verification for Neural Networks and Cyber-Physical Systems with Reachability Methods”, Probably Safe Robotics Lecture at Carnegie Mellon University (CMU), online, Invited by Prof. Changliu Liu
- March 8, 2021, “Formal Verification for Neural Networks and Cyber-Physical Systems with Reachability

Methods”, Waterloo ML + Logic Colloquium organized by the Waterloo AI Institute and Cybersecurity and Privacy Institute (CPI) at the University of Waterloo, online, Invited by Prof. Vijay Ganesh

## Journal Reviews (Since 2021)

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- Transactions on Embedded Systems (May 2022)
- Transactions on Embedded Systems (April 2022)
- Journal of Aerospace Information Systems (Dec 2021)
- Journal of Systems Research (Nov 2021)
- Automatica (Oct 2021)
- Transactions on Cyber-Physical Systems (Sep 2021)
- IEEE Computer (Mar 2021)
- Transactions on Cyber-Physical Systems (Jan 2021)
- Automatica (Jan 2021)

## Students with Working / Advisory Relationship

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- Niklas Kochdumper (Postdoc), since Fall 2021
- Feiyang Cai (Postdoc), since Fall 2022
  
- Ertai Luo (PhD), since Spring 2022
- Sanaz Sheikhi (PhD), since Fall 2021
- Sayak Ghosal (PhD in AMS), Spring 2022
- Andrew Mata (PhD), since Spring 2021
- Veena Krish (PhD), since Spring 2021, advised by Amir Rahmati
- Usama Mehmood (PhD, graduated), Fall 2020, advised by Scott Smolka and Scott Stoller
  
- Giorgian Borca-Tasciuc (MS, graduated), Spring 2022
- Abhinav Chawla (MS), Summer 2021 - Fall 2022, MS Thesis title “Testing Strategies and Designing Controllers for Autonomous Racing”, defended on Dec 1, 2022, hired by Waymo
- Adithya Guduru (MS), Spring 2022 - Fall 2022
  
- Akshat Gupta (High School Student in Simons Program), Summer 2022
  
- Chiao Hsieh (PhD Committee Member, University of Illinois at Urbana-Champaign), November 2021
- Syed Fahad Sultan (PhD Committee Member), August 2021
- Patrick Musau (PhD Committee Member, Vanderbilt University), May 2021
- Nathan Jewell (Undergraduate Thesis Committee Member, Oregon State University), Jan 2021
- Aaron W. Fifarek (MS Thesis Committee Member, Wright State University), 2018

## Spoken Languages

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- English (Native)
- Polish (Heritage)
- Mandarin Chinese (Advanced Intermediate)