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Professor Koushik Sen
Computer Science Division, 735 Soda Hall #1776
University of California, Berkeley CA 94720-1776
PHONE: (510) 642-2420 EMAIL: ksen@cs.berkeley.edu

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To whom it may concern:

It is my great honor to write this letter of recommendation for Kevin Laeuer, my advisee for the last several years. Kevin is super smart, hard-working, and driven, with excellent communication skills, and he is an exemplary mentor. He has the full potential to become a world-class researcher and teacher.

Kevin joined UC Berkeley in Fall 2016 as an exchange student from Germany and took my graduate course on Advanced Topics in Testing, Debugging, and Program Analysis. Impressed by his drive, dedication, and attention to detail, I encouraged him to apply for a Ph.D. He was accepted at all top schools, including UC Berkeley, MIT, and Stanford; I was thrilled to keep him at Berkeley.

Kevin's research spans hardware design verification, testing, debugging, and repair. His early work brought coverage-guided fuzzing (CGF) — the algorithm behind tools such as Google's AFL that has found vast numbers of critical bugs and security vulnerabilities in real-world software — to RTL circuits, where decades of attempts to automate stimuli generation from coverage feedback had failed to gain adoption. Kevin proposed an approach that requires minimal setup and exploits FPGA-accelerated simulation for rapid testing. He found that resetting a circuit is a crucial bottleneck and implemented transformation passes that make it feasible to reset arbitrary RTL designs quickly, a requirement for deterministic test execution. He released his implementation, RFUZZ, as open-source software. Jonathan Bachrach and I were hands-off; Kevin figured it all out himself. The paper appeared at ICCAD 2018, one of the two top conferences in computer-aided design — rare for a first-year Ph.D. student working with so little help from his advisors — and has inspired several subsequent research efforts on hardware fuzzing.

While working on RFUZZ, Kevin realized that fuzzing could improve with richer coverage information, which most open-source and academic RTL simulators do not support. His key insight: if every simulator implements a single new cover primitive, then line, toggle, finite-state-machine, and other metrics can be implemented as compiler passes, independent of the backend simulator. He built a prototype for the Chisel hardware construction language, demonstrated it across three software simulators, the FPGA-accelerated FireSim simulator, and a formal tool, and showed for the first time that detailed line coverage can be collected while booting Linux on FireSim at 65 MHz. This ground-breaking work, published at ASPLOS 2023 and released publicly, lets any simulator obtain rich coverage metrics for free. Again, Kevin ran the show: he conceived, implemented, and validated the idea; I merely listened in our one-on-one meetings.

Kevin also made a major contribution to the widely-popular open-source Chisel ecosystem by adding bounded model checking to the ChiselTest library, making a formal technique accessible to regular developers. His tool showed how hardware generators make even simple formal techniques more powerful, enabling checkers parameterized on signal sizes, FIFO depths, and more, with exact replay so dynamic-testing debug infrastructure can be reused. The upstream Chisel project used it to verify library components; it has uncovered several bugs in FIFO implementations, inspired further community work, and been integrated into a formal verification course at UC Santa Cruz.

Most recently, Kevin reframed automated program repair as a debugging tool that provides rapid repair suggestions. His repair tool for Verilog RTL circuits combines symbolic repair templates with SMT-based bounded model checking, and scales to long failing tests via an adaptable unrolling window around the bug manifestation time step. It correctly repairs half of the benchmarks — versus one-third for the state-of-the-art tool CirFix — and answers in under ten seconds where CirFix often takes minutes or hours. Kevin will soon submit this work to a premier conference.

Kevin's proposal-writing skills are remarkable. He conceived the ChiselTest formal verification project and wrote a full proposal for a highly competitive Semiconductor Research Corporation (SRC) grant; Jonathan Bachrach and I only helped structure it. It was funded for three years — rare for a second-year graduate student. He will have no problem raising funds. His open-source participation is equally exemplary: an active member of the Chisel community since 2019, and maintainer of the official ChiselTest verification library since 2020.

Teaching is Kevin's passion, and he does it really well. He has taught three distinct classes at UC Berkeley, served as a TA, and lectured at UC Santa Cruz. His philosophy centers on feedback-driven instructional design, respecting students' time, and using experiments and visualization; he is keen to develop a class on automated bug-finding and verification. He has mentored over ten undergraduate and graduate students with a student-centered approach. One mentee wrote: "He is an exceptional mentor and I have no doubt that Kevin will improve the lives of many students to come." Another: "It would not be an overstatement to say that the Ph.D. position I got today owes partly to Kevin."

Kevin is a complete package with the DNA of a research and teaching leader: visionary, independent, driven, hard-working, an excellent communicator, and a perfectionist. He is a better version of Michael Pradel, my former post-doc and now a full professor at the University of Stuttgart, Germany. I give Kevin my strongest recommendation without any reservations for a faculty position in your department.

Sincerely,

Koushik Sen
Professor, Computer Science Division
University of California, Berkeley