Grenoble INP - UGA is a renowned public institution of higher education and research, and a major player in the Grenoble ecosystem. It is the engineering and management institute of Grenoble Alpes University, and plays a leading role in the scientific and industrial community.

Researcher in Hardware Design Verification

<table>
<thead>
<tr>
<th>Job reference number</th>
<th>2024-RESHARDWDESIGN-TIMA</th>
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<tbody>
<tr>
<td>Research field</td>
<td>Digital Electronics (Hardware Verification, Fuzz Testing)</td>
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<tr>
<td>Host laboratory</td>
<td>TIMA (UMR 5159 Grenoble-INP, UGA and CNRS) / Website : <a href="https://tima.univ-grenoble-alpes.fr/">https://tima.univ-grenoble-alpes.fr/</a></td>
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<tr>
<td>Researcher profile</td>
<td>Recognized researcher – (R2)</td>
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<tr>
<td>Location</td>
<td>Grenoble, France</td>
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<tr>
<td>Date of recruitment / contract length</td>
<td>16/09/2024 (12 months)</td>
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<tr>
<td>Contacts</td>
<td><a href="mailto:giorgio.di-natale@univ-grenoble-alpes.fr">giorgio.di-natale@univ-grenoble-alpes.fr</a></td>
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Grenoble INP - UGA is a leading public institution accredited with the French label “Initiative d’excellence”. It offers innovative engineering and management programs, with an increasing internationalization of its course offers. The courses are grounded in sound scientific knowledge and linked to digital, industrial, organizational, environmental and energy transitions. The Engineering and Management Institute of Grenoble Alpes brings together more than 1300 staff members (teacher-researchers, lecturers, administrative and technical staff) and 8300 students, located on 8 sites (Grenoble INP - Ense3, Grenoble INP - Ensimag, Grenoble INP - Esisar, Grenoble INP - Génie industriel GI, Grenoble INP - Pagora, Grenoble INP - Phelma, Polytech Grenoble, Grenoble IAE and the INP Prepa). Grenoble INP is also a highly-ranked institution of higher education and research, leading the way in the fields of engineering and management on an international scale. It is a member of a large number of international academic and research networks. It is part of the European University UNITE!.

As part of Grenoble Alpes University, Grenoble INP has associated guardianship of 39 national and international research laboratories and of technological platforms. The research conducted there benefits both its socio-economic partners and its students. Grenoble INP is at the heart of the following scientific fields: physics, energy, mechanics and materials; digital; micronanoelectronics, embedded systems; industry of the future, production systems, environment; management and business sciences.

Grenoble INP - UGA is an equal opportunity employer committed to sustainability. Grenoble INP-UGA celebrates diversity and equity and is committed to creating an inclusive environment for all employees. All qualified applications will be considered without discrimination of any kind.
TIMA (Mixed Research Unit No. 5159) is a public research laboratory under the supervision of the CNRS (National Center for Scientific Research), Grenoble INP (Grenoble Institute of Technology), and UGA (University Grenoble Alpes). TIMA is a cosmopolitan team, with researchers and interns from around the world. The research topics of the TIMA Laboratory cover the specification, design, verification, testing, CAD tools and design aid methods for integrated systems, from basic analog and digital components to multi-processor systems on chip and their basic operating system. The Laboratory is organized into 4 research teams:

- AMfoRS: Architectures and Methods for Resilient Systems
- CDSI: Circuits, Devices and System Integration
- RMS: Reliable Mixed-signal Systems
- SLS: System Level Synthesis

The proposed postdoc will take place within the AmfoRS and CDSI teams, under the supervision of Giorgio Di Natale and Katell Morin.

Offer description:

In the field of hardware design, ensuring the correctness and reliability of designs is crucial for achieving optimal performance and functionality. Functional verification ensures that a system’s design meets its specification before manufacturing, by identifying and rectifying design errors. Among the various methods for ensuring system correctness, Assertion-Based Verification (ABV) has emerged as one of the most promising solutions for verifying design functionality. Conversely, testing methods like fuzz testing play a crucial role in pinpointing design flaws and errors. Fuzzing techniques identify flaws in the design by providing unexpected test input to the design and monitoring unusual outcomes, such as crashes and failures. During fuzz testing, a substantial volume of input data is generated and crashes are observed. This data is often voluminous and complex, rendering the testing process time-consuming and costly. Given the limitations of current fuzzers, there is a pressing need to enhance the effectiveness of these techniques to address the increasing complexity of modern hardware designs.

Objective:

The primary objective of this research is to enhance the effectiveness of fuzz testing methods for hardware design verification and testing by integrating association rule mining techniques. In this research, our goal is to introduce a novel fuzzer capable of serving as both a testing and verification method for hardware designs. By leveraging data mining approaches, we aim to improve the identification and prioritization of test cases, leading to a more targeted fuzzing process. Additionally, our purpose is to improve the efficiency of the verification process and increase the design behavior coverage of the hardware designs using assertions generated with the proposed fuzzer.

Methodology:

In this research project, we aim to propose association rule mining algorithms to integrate them into the fuzz testing framework for hardware design verification and testing. The methodology involves employing association rule mining algorithms to analyze the input data of the proposed fuzzer, along with the fuzzer’s report on hardware design errors and faults, including their characteristics and impact on design functionality. These association rule mining algorithms aid in identifying correlations among the input data and design errors resulting from these inputs. Subsequently, the proposed method prioritizes test cases based on the identified correlations. Furthermore, as part of this analysis, a set of assertions is specifically generated for detecting the analyzed design errors.

Expected Outcomes:

- More targeted fuzzing: By identifying associations in input data, the fuzzing process can be directed towards areas of the design that are more likely to contain errors.
- Efficient anomaly detection: Association rules can help in recognizing anomalies in the behavior of the design caused by specific inputs.
- Less memory overhead: The proposed method is expected to result in reduced memory overhead and improved performance compared to existing state-of-the-art fuzzers.
- Faster fuzzing process: Incorporating association rule mining techniques is anticipated to significantly decrease the execution time of the proposed fuzzer compared to other existing fuzzers.
- Enhanced design verification: A key distinction between the proposed fuzzer and state-of-the-art methods is its ability to generate assertions alongside fuzz testing.
Specific requirements or conditions

- Strong background in hardware design, functional verification, and data mining techniques.
- Experience in assertion-based verification (ABV) and fuzz testing for hardware design verification and testing.
- Familiarity with association rule mining algorithms and their applications.
- Proficiency in programming languages such as C, C++, Python, or Java.
- Strong analytical and problem-solving skills.
- Excellent communication and teamwork skills.
- Experience with hardware description languages (HDLs) such as VHDL, Verilog, or SystemVerilog.
- Familiarity with hardware design tools such as simulation, synthesis, and place-and-route tools.
- Experience in working with FPGA or ASIC design flows.
- Knowledge of design for test (DFT) techniques and design for debug (DFD) techniques is a plus.
- Experience in developing and integrating algorithms into existing software frameworks.
- Ability to work independently and in a team environment.
- Strong publication record in relevant conferences and journals is a plus.
- Proficiency in English is required.

Specifics of the position

The research will be led at TIMA (46, avenue Felix Viallet, Grenoble - France).

Position assigned to a restricted area: YES/NO

(Device for the protection of the scientific and technical potential of the nation, conditioning the appointment of the researcher to the authorization of the Defense Security Officer).

How to apply

Our team welcomes applicants with diverse backgrounds and experiences. We regard gender equality and diversity as a strength and an asset.

Applications must be sent to: giorgio.di-natale@univ-grenoble-alpes.fr

Application deadline: 17/05/2024 (May 17th)