

INESC TEC | Research Grant (AE2024-0411) INESC TEC

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Posted Oct. 7, 2024, set to expire Feb. 6, 2025

Job Title	INESC TEC Research Grant (AE2024-0411)
Department	HASLAB
Institution	INESC TEC BRAGA, , Portugal
Date Posted	Oct. 7, 2024
Application Deadline	Oct. 16, 2024
Position Start Date	Oct. 3, 2024
Job Categories	Graduate Student
Academic Field(s)	Engineering - Other
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Job Description	

Research Opportunities

Theory of Programming Languages

Work description

The current notions of approximate equivalence for (higher-order) quantum programming do not take important operations into account. Specifically the corresponding mathematical model does not include measurements, nor classical control flow, nor discard operations. Also the corresponding typing system is often times too strict, and cannot properly handle multiple uses of the same resource.

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The overarching goal of this project is to tackle the aforementioned limitations. A successful completion of this goal will provide a fully-fledged quantum programming language on which to study approximate program equivalence in various scenarios. This includes not only quantum algorithmics where for example the number of iterations in Grover's algorithm involves approximations but also in quantum information theory, where for example quantum teleportation and the problem of the discrimination of quantum states have important roles.

The first two months of this project are devoted to a background study on the topics of programming theory, lambda-calculus, and (graded) typing systems that are suited to the use of a resource multiple times. The next three months are allocated to extending suitable (higher-order) approximate quantum models with measurement, classical control flow, and discard operations. The subsequent two months will be dedicated to enriching the respective typing system so it can properly support multiple uses of the same resource.

Finally the last month will be devoted to writing a report that sums up all the results obtained. Throughout the whole project we will use a number of simple case-studies to illustrate and benchmark the prospective results.

Academic Qualifications

- MSc student in physical engineering or related field.

Minimum profile required

- Experience with quantum computing, lambda-calculus, and functional programming.
- B.Sc. completed with overall grade ≥ 15 ;
- Current overall grade M.Sc. degree ≥ 15 ;

Preference factors

- M.Sc. course with focus on the three topics that were previously mentioned;
- High overall grade in the M.Sc. degree.

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Application Period

Since 03 Oct 2024 to 16 Oct 2024

Centre

High-Assurance Software

Scientific Advisor

[Renato Jorge Neves](#)

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Contact Information

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