

RUPANSHU SOI

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EDUCATION

Birla Institute of Technology and Science, Pilani

Bachelor of Engineering in Computer Science

2018–2022

CGPA: 9.12

Thesis: Scaling Implicit Parallelism with Index Launches [PDF]

RESEARCH EXPERIENCE

Cross Products & Ordered Launches

Fall 2021

SLAC National Accelerator Laboratory

- Developed the program analysis to support cross products, a new data abstraction, in the index launch optimization in the Regent compiler. [PR]
- Explored a design and implementation of ordered launches, which generalize index launches by supporting limited forms of pipeline parallelism.
- Advised by [Dr. Elliott Slaughter](#). Collaborated with [Legion](#) contributors.

Exploring LLVM using the Anaximander Approach

Summer 2021

MITACS Globalink Research Intern

- Explored the feasibility of using the Anaximander approach, a general technique for microservice exploration, to reverse-engineer a compiler's architecture.
- Developed modular probes to extract information about LLVM's internal architecture, and techniques to recursively compose this information to construct *maps* about LLVM.
- Advised by [Prof. Sébastien Mosser](#) and [Prof. Jean Privat](#).

Hybrid Analysis for Index Launches

Fall 2020–Spring 2021

Remote Collaboration

- Implemented a hybrid (static + dynamic) program analysis in the Regent compiler. [PRs]
- Greatly increased the scope of the index launch optimization by providing safety guarantees in cases unsuceptible to static analysis.
- Advised by [Dr. Elliott Slaughter](#). Collaborated with [Legion](#) contributors.

Development of an Implicitly Parallel Meshfree Solver in Regent

Spring 2020

BITS Pilani

- Wrote a high-performance CFD solver in Regent's implicitly parallel programming model. [Code]
- Achieved higher performance than corresponding Fortran and Julia implementations.
- Advised by [Dr. Anil Nemili](#).

REFEREED PUBLICATIONS

R. Soi, M. Bauer, S. Treichler, M. Papadakis, W. Lee, P. McCormick, A. Aiken, and E. Slaughter.
Index Launches: Scalable, Flexible Representation of Parallel Task Groups. [Abstract][PDF][Slides][Talk]
In *High Performance Computing, Networking, Storage and Analysis (SC '21)*, November 2021.

R. Soi, N. R. Mamidi, E. Slaughter, K. Prasun, A. Nemili, and S. M. Deshpande.
An Implicitly Parallel Meshfree Solver in Regent. [Abstract][PDF][Slides]
In *Parallel Applications Workshop: Alternatives to MPI+X (PAW-ATM)*, November 2020.
In conjunction with *High Performance Computing, Networking, Storage and Analysis (SC '20)*.

SUMMER SCHOOLS

Programming Language Implementation Summer School (PLISS)

Summer 2021

SELECTED PROJECTS

Open-Source Contributions to the Regent Compiler	<i>2020–2021</i>
<ul style="list-style-type: none">Added the <code>__import_cross_product</code> and <code>__future</code> keywords, support for some bitwise operators, and reported several bugs. [PRs][Bug Reports]	
Misty: A Scheme Interpreter in Lua	<i>Spring 2021</i>
<ul style="list-style-type: none">Implemented lexical scoping, HOFs, and tail-call optimization. [Code]	
Selective Repeat Inspired File Transfer Protocol in Racket	<i>Spring 2021</i>
<ul style="list-style-type: none">Built reliability against packet loss, corruption, reordering, and delays over UDP sockets. [Code]	
Runi: Handwritten Lexer and Parser in Go	<i>Spring 2021</i>
<ul style="list-style-type: none">Wrote a CFG, lexer, and predictive recursive descent parser for a C-like language. [Code]Visualized the parse tree using Graphviz.	

TEACHING ASSISTANTSHIPS

Compiler Construction	<i>Spring 2022</i>
Theory of Computation	<i>Fall 2021</i>
Operating Systems	<i>Spring 2021</i>
Differential Equations (Math III)	<i>Fall 2020</i>
Mechanics, Oscillations and Waves (Physics I)	<i>Spring, Fall 2019</i>

SCHOLASTIC ACHIEVEMENTS

MITACS Globalink Research Internship	<i>Summer 2021</i>
<ul style="list-style-type: none">Competitive 12-week undergraduate research internship. [Website]15,000 CAD grant to pursue graduate study in Canada. Declined.	
BITS Pilani Merit Scholarship	<i>Spring, Fall 2019</i>
<ul style="list-style-type: none">Top 1-3% of the batch.	
Sir CV Raman Prize	<i>Spring 2019</i>
<ul style="list-style-type: none">Awarded to the top student in Physics I.	
10/10 Semester GPA	<i>Fall 2018</i>
<ul style="list-style-type: none">Top 5 in 1100 students.	

PROGRAMMING SKILLS

Languages	C, Python, Lua, Go, Racket, Regent
Systems	LLVM, Flex, Bison, Linux, MERN stack, \LaTeX

LEADERSHIP & MANAGEMENT EXPERIENCE

Joint Secretary, Ad Astra (Astronomy and Science Club)	<i>Fall 2019–Spring 2020</i>
<ul style="list-style-type: none">Managed and organized club activities including discussions, talks, quizzes and star-gazing sessions.Responsible for club events during our annual technical fest, ATMOS.	