RUPANSHU SOI

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EDUCATION

Birla Institute of Technology and Science, Pilani *2018–2022*
Bachelor of Engineering in Computer Science ***CGPA: 8.99***

Thesis: Scaling Implicit Parallelism with Index Launches

RESEARCH EXPERIENCE

Cross Products & Ordered Launches *Fall 2021*
Undergraduate Thesis

- Developed the program analysis to support cross products, a new data abstraction, in the index launch optimization in the Regent compiler. [PR]
- Exploring a design and implementation of ordered launches, which generalize index launches by supporting tasks with structured dependencies.
- 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 unsusceptible 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][Paper][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][Paper][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*

Programming Language Analysis and Optimizations *Summer 2021*
Hosted online by IIT Hyderabad

SELECTED PROJECTS

Open-Source Contributions to the Regent Compiler *2020–2021*

- Added the `__import_cross_product` and `__future` keywords, support for some bitwise operators, and reported several bugs. [PRs][Bug Reports]

Misty: A Scheme Interpreter in Lua *Spring 2021*

- Implemented lexical scoping, HOFs, and tail-call optimization. [Code]

Selective Repeat Inspired File Transfer Protocol in Racket *Spring 2021*

- Built reliability against packet loss, corruption, reordering, and delays over UDP sockets. [Code]

Runi: Handwritten Lexer and Parser in Go *Spring 2021*

- Wrote a CFG, lexer, and predictive recursive descent parser for a C-like language. [Code]
- Visualized the parse tree using Graphviz.

TEACHING ASSISTANTSHIPS

Theory of Computation *Fall 2021*

Operating Systems *Spring 2021*

Differential Equations (Math III) *Fall 2020*

Mechanics, Oscillations and Waves (Physics I) *Spring, Fall 2019*

SCHOLASTIC ACHIEVEMENTS

MITACS Globalink Research Internship *Summer 2021*

- Competitive 12-week undergraduate research internship. [Website]
- 15,000 CAD grant to pursue graduate study in Canada. Declined.

BITS Pilani Merit Scholarship *Spring, Fall 2019*

- Top 1-3% of the batch.

Sir CV Raman Prize *Spring 2019*

- Awarded to the top student in Physics I.

10/10 Semester GPA *Fall 2018*

- 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) *Fall 2019–Spring 2020*

- Managed and organized club activities including discussions, talks, quizzes and star-gazing sessions.
- Responsible for club events during our annual technical fest, ATMOS.