Kuntal Das Barman
Born on 6th November 1975
Durgapur, West Bengal, India
Married to Sampa Das Barman

Project LEMME
INRIA-Sophia Antipolis
France

Curriculum Vitae

Degrees and Professional Experiences

from May, 2001	**Ph.D. student** in Computer Science, INRIA Sophia Antipolis - France *Area of research* : Formal Semantics and verification
2001 (Feb-Apr)	**Software Engineer** in VLSI Tools, Agere Systems (formerly, Lucent Microelectronics) - India
1998 - 2000	**Master of Science (Engg)** in Computer Science and Automation, Indian Institute of Science - India *Area of research* : Approximation algorithms - Ranked 65th in All India GATE
1994 - 1998	**Bachelor of Computer Science and Engineering**, Jadavpur University[1] - India - Ranked 96th in West Bengal Joint Entrance Examination

Research

Ph.D.

Since May 2001, I am a Ph.D. student under supervision of Yves Bertot in **INRIA - Sophia Antipolis, France** in the Lemme group. In my thesis I work in the area of formal semantics and verification of programming languages.

In a first work, we describe the operational and denotational semantics of a small imperative language in type theory with inductive and recursive definitions. The operational semantics is given by natural inference rules, implemented as an inductive relation. The realization of the denotational semantics is more delicate : the nature of the language imposes a few difficulties on us. First, the language is Turing-complete, and therefore the interpretation function we consider is necessarily partial. Second, the language contains strict sequential operators, and therefore the function necessarily exhibits nested recursion. Our solution combines and extends recent work by the authors and others on the treatment of general recursive functions and partial and nested recursive functions. The first new result is a technique to encode the approach of Bove and Capretta for partial and nested recursive functions in type theories that do

[1]Recognized as one of the 5 best universities in India

not provide simultaneous induction-recursion. A second result is a clear understanding of the characterization of the definition domain for general recursive functions, a key aspect in the approach by iteration of Balaa and Bertot. In this respect, the work on operational semantics is a meaningful example, but the applicability of the technique should extend to other circumstances where complex recursive functions need to be described formally. This work has been published in TPHOLs 2002 [BCDB].

Conventional approach to describe the semantics of programming language usually rely on relation, in particular inductive relations. Simulating program execution then relies on proof search tools. In a second work, we describe a functional approach to automate proofs about programming language semantics. Reflection is used to take facts from the context into account. The main contribution of this work is that we developed a systematic approach to describe and manipulate unknown expressions in the symbolic computation of programs for formal proof development. The tool we obtain is faster and more powerful than the conventional proof tools. This work is available as INRIA Research Report [DBB].

Currently I am a member of *Concert* project in INRIA. The principal objective of the Concert project is to formalize and certify optimizing compilers for general-purpose programming languages in the family of the C programming language. The initial objective is to develop this formalization and this certification in the framework of the calculus of inductive constructions and to take advantage of the characteristics of this system to produce certified software, for instance with the extraction mechanism. The idea is to start with C, but without considering very complicated constructs like array, goto or setjmp/longjmp, functions with variable number of arguments etc. We named it C−−. Instead of generating object code directly, we move to an intermediate code, written in a register transfer language(RTL), where we decide the control flow, allocate registers, verify constant propagation, dead code elimination and do optimization. Linearization is taken care of while generating object code from RTL code. We extend our previous work [BCDB] to formalize the language C−−. I wrote a formalized compiler to compile the source code in C−− to the intermediate RTL code, which involves a clear understanding of both the C−− and RTL formalisation. This formalization of compiler is quite complex due to the vastness of the C−− and the RTL and also because of the presence of nested and mutually recursive functions. Finally, our objective is to prove that the commutation diagram between C−− and RTL holds.

M.Sc.(Engg.)

I did my *Master of Science (Engg.)* in *Computer Science and Automation* from **Indian Institute of Science, India**. I wrote my thesis, titled *A Survey on the Approximation Techniques for Network Design and Multiple Tool Milling Problems*, under guidance of Ramesh Hariharan. My thesis starts with the study of *General approximation techniques for constrained forest problems* by M. Goemans and D. Williamson. Then it goes on surveying how one can use this technique to get a constant factor approximation for k *Minimum Spanning Tree*, which includes 3-Approximation by Naveen Garg, 2.5-Approximation by Sunil Arya and Ramesh Hariharan and $2+\epsilon$-Approximation by Sanjeev Arrora and George Karakostas. Then it shows how the general approximation techniques can be applied on other related problems to get a constant factor approximation. We then contributed an exact algorithm and a constant factor approximation for the *Multiple Tool Milling Problem On A Straight Line*. It finally concludes how the general approximation technique by Goemans and Williamson can be used on Multiple Tool Milling Problem.

Bachelor of Engineering

I did my B.E. in *Computer Science and Engineering* from **Jadavpur University**, Calcutta, India.

Major Projects in B.E.

1. In a summer project I experimented with the Meta-heuristics, like Genetic Algorithm and Tabu Search, on the Pallet Loading Problem [JDBB]. This project was done in **Indian Institute of Management, Calcutta, India** under guidance of *Subir Bhattacharya*.
2. I wrote my final year B.E. project report "A comparative study of two routing and wavelength assignment algorithms" in all-optical networks under guidance of *Debashis Saha*.

Schools and Conferences

- TYPES Summer School'02 : Theory and Practice of Formal Proofs, Giens - France, September 2-13, 2002
- TPHOLs 2002 : 15th International Conference on Theorem Proving in Higher Order Logics, Hampton-Virginia - USA, 20th-23rd August 2002
- The 30th Spring School Theoretical Computer Science : Semantics of Programming Languages, AGAY(VAR) - FRANCE, 24 - 29 March, 2002
- Verificard 2002 : Marseille-Luminy - France, 7th-9th January 2002

Publications

- **International Conference :**

[BCDB] Yves Bertot, Venanzio Capretta and Kuntal Das Barman. Type-theoretic functional semantics, Proceedings of TPHOLs 2002, LNCS-2410.

[DBB] Kuntal Das Barman and Yves Bertot. Proof by reflection in semantics, INRIA Research Report RR-5134.

- **National Conference :**

[JDBB] Prakash Jalan, Kuntal Das Barman and Subir Bhattacharya. Experimenting with Genetic Algorithm on Pallet Loading Problem, *32nd Annual Proceedings of Computer Society of India*, pages 27–33, Tata McGraw-Hill - India, 1997.

Software skills

- Environment : Linux, Unix, Windows 98/2000/NT, Solaris
- Programming Languages : C/C++, Java, Pascal
- Programming Scripts : Perl, Bash, HTML
- Functional programming : Caml, Lisp
- Theorem Prover : Coq

Languages

English, French, Hindi, Bengali.

Other interests

Photography, playing Harmonica, adventure sports (Rock climbing, Trekking, Snorkeling and others), traveling and cooking.

References

Yves Bertot
INRIA Sophia Antipolis
2004 route des lucioles
BP 93, Projet Lemme
06902 Sophia Antipolis Cedex
France
Email : Yves.Bertot@sophia.inria.fr

Ramesh Hariharan
Computer Science & Automation
Indian Institute of Science
Bangalore 560012
Karnataka
India
Email : ramesh@csa.iisc.ernet.in

Contact infos :

Current :
2004 route des lucioles
BP 93
06902 Sophia Antipolis Cedex
France
Email : Kuntal.Das_Barman@sophia.inria.fr

Permanent :
61, 1st Avenue
SEPCO Township
Durgapur 713205, West Bengal
India
Email : kuntaldb@yahoo.co.in