Frank Fu

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Education

- Ph.D. Department of Computer Science, the University of Iowa, Iowa City, Iowa, USA. August 2009 - August 2014. Major: Computer Science

- B.Eng. School of Computer Science, Huazhong University of Science and Technology, Wuhan, Hubei, China. September 2005 - July 2009. Major: Information Security

Academic Positions

- Postdoctoral Research Assistant, Heriot-Watt University, Edinburgh, UK. March 2016 - August 2016. Principal Investigator: Ekaterina Komendantskaya

- Postdoctoral Research Assistant, University of Dundee, Dundee, UK. October 2014 - March 2016. Principal Investigator: Ekaterina Komendantskaya

Research Interests

- Lambda calculus, type theory and their applications.

- Theorem proving and language-based verification.

- Type systems for functional programming languages.

Conference Publications

1. **Proof Relevant Corecursive Resolution**.

   Peng Fu, Ekaterina Komendantskaya, Tom Schrijvers, Andrew Pond. International Symposium on Functional and Logic Programming, FLOPS 2016.

2. **A Type-Theoretic Approach to Resolution**.

   Peng Fu, Ekaterina Komendantskaya. International Symposium on Logic-Based Program Synthesis and Transformation, LOPSTR 2015.

3. **Self Types for Dependently Typed Lambda Encodings**.

   Peng Fu, Aaron Stump. Joint 25th International Conference on Rewriting Techniques and Applications and 12th International Conference on Typed Lambda Calculi and Applications, RTA-TLCA 2014.

Journal Publication

1. **Operational Semantics of Resolution and Productivity in Horn Clause Logic**.

   Peng Fu, Ekaterina Komendantskaya. Formal Aspect of Computing, Journal Version of LOPSTR 2015, to appear.

2. **Efficiency of Lambda-Encodings in Total Type Theory**.

   Aaron Stump, **Peng Fu**. Journal of Functional Programming, 2016.

Workshop Publications

1. **Equational Reasoning about Programs with General Recursion and Call-by-value Semantics**.

    Garrin Kimmell, Aaron Stump, Harley Eades III, **Peng Fu**, Tim Sheard, Stephanie Weirich, Chris Casinghino, Vilhelm Sjoberg, Nathan Collins, Ki Yung Ahn. Programming Languages meets Program Verification, PLPV 2012.

2. **Irrelevance, Heterogeneous Equality, and Call-by-value Dependent Type Systems**.

    Vilhelm Sjoberg,Chris Casinghino, Ki Yung Ahn, Nathan Collins, Harley Eades III, **Peng Fu**, Garrin Kimmell, Tim Sheard, Aaron Stump, Stephanie Weirich. Mathematically Structured Functional Programming, MSFP 2012.

3. **A Framework for Internalizing Relations into Type Theory**.

    Peng Fu, Aaron Stump, Jeff Vaughan. International Workshop on Proof-Search in Axiomatic Theories and Type Theories, PSATTT 2011.

Dissertation

- Title: **Lambda Encodings in Type Theory**.

- Summary: The dissertation explores the reasoning of Scott-encoded programs using the comprehension principle.

- Committee: Aaron Stump, Cesare Tinelli, Kasturi Varadarajan, Ted Herman, Douglas Jones.

Teaching Experiences

- Teaching Assistant, *Algorithm and AI*, 2015 Spring. Computer Science, The University of Dundee.

    - Taught basic functional programming in Haskell, the first Haskell class taught in University of Dundee.
    - Delivered one lecture per week (total 13 lectures, class size: around 50).
    - Ran one lab session per week.
    - Developed class materials, homeworks and part of the final exam.

- Graduate Teaching Assistant, *Programming Language Concepts*, 2013 Spring, 2014 Spring. Department of Computer Science, The University of Iowa.

    - Graded assignments (Class size: around 70 both times).
    - Ran weekly office hours.

- Graduate Teaching Assistant, *Object-Oriented Software Development*, 2013 Fall. Department of Computer Science, The University of Iowa.

    - Graded assignments (Class size: around 70).
    - Ran one lab session per week.
    - Ran weekly office hours.

- Graduate Teaching Assistant, *Computer Networking*, 2009 Fall. Department of Computer Science, The University of Iowa.

    - Graded assignments (Class size: around 30).
    - Ran weekly office hours.

Research Projects

- **Functional Certification of Rewriting (FCR)**[1]. A prototype type checker for analyzing and proving the nontermination of term rewriting system. Main features:

  - The certification of nonterminating rewriting is reduced to type checking.
  - The type checking algorithm is based on resolution with second-order matching.

- **Corecursive Type Class**[2]. A prototype interpreter and type checker that implements the type class mechanism based on corecursive resolution. Main features:

  - It supports dictionary construction for nonterminating type class resolution.
  - It uses goal directed automated proof construction to construct type class evidence.
  - It provides a heuristic for generating intermediate lemma for proof construction.

- **The Gottlob System**[3]. A prototype interpreter for typed functional programming and theorem proving. Main features:

  - The functional programming fragment is equipped with Hindley-Miler type inference. The core language is based entirely on Scott encoding, without build-in data-type and pattern matching.
  - The theorem proving fragment can reason about the program with general recursion.
  - It can automatically synthesize an induction principle from an algebraic data type declaration, induction principle is not primitive in Gottlob.

Conferences and Workshops Presentations

- **Proof Relevant Corecursive Resolution**. June 22, 2016, The Scottish Programming Languages Seminar, Heriot-Watt University, Edinburgh, UK.

- **A Type-Theoretic Approach to Structural Resolution**. July 13, 2015, LOPSTR, Siena, Italy.

- **Self Types for Dependently Typed Lambda Encodings**. July 15, 2014, RTA-TLCA, Vienna, Austria.

- **Dependent Lambda Encoding with Self Types**. September 2013, ACM SIGPLAN Workshop on Dependently-Typed Programming(DTP), Boston, MA.

- **A Framework for Internalizing Relations into Type Theory**. August 2011, PSATTT workshop, Wroclaw. Poland.

Professional Service

- External Reviewer. 24th International Conference on Rewriting Techniques and Applications (RTA 2013). Reviewed: 1 paper.

- External Reviewer. 19th International Conference on Foundations of Software Science and Computation Structures (FoSSaCS 2016). Reviewed: 1 paper.

- External Reviewer. 32nd International Conference on Logic Programming (ICLP 2016). Reviewed: 1 paper.

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[1]Source code available from: `https://github.com/fermat/fcr`
[2]Source code available from: `https://github.com/fermat/corecursive-type-class`
[3]Source code available from: `https://github.com/fermat/gottlob`