Verification and Testing Research Group

Prof Georg Struth
Dr Anthony Simons

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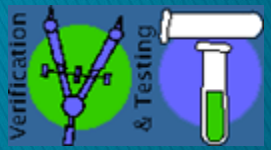

VT Group Mission

- Theory
  - to advance the state-of-the-art in theoretical computer science
- Practice
  - to apply theoretical results in innovative and practical solutions for industry
- Together
  - Advanced Computing Research Centre (ACRC)
  - technology transfer, collaborative research

VT Research Themes

- Logic and Algebras
  - process algebras and theorem proving
  - formal specification and refinement
  - unconventional models of computation
- Software Engineering
  - model-based and search-based testing
  - reverse engineering of specifications
  - massively parallel multi-agent simulation
  - distributed XML data manipulation

Algebras and Algorithms

- Prof Georg Struth
  - logical and Kleene algebraic methods with interactive theorem proving
  - foundations of sequential and concurrent computing and program verification tools
- Dr Dirk Sudholt
  - evolutionary algorithms, population genetics
- Industry
  - Microsoft Research
  - formal software development, program verification; new models of evolution and adaptation

Specification and Refinement

- Prof John Derrick
  - formal specification in Z/CSP, model-checking and refinement of state-based systems
  - concurrent process algebras for refinement
- Dr Ramsay Taylor
  - code quality and test adequacy for Erlang
- Industry
  - Ericsson, Quviq, via EU FP7 Prowess
  - frameworks for distributed systems, specification templates, model-checkers, code coverage tools

Unconventional Computing

- Dr Mike Stannett
  - computational models inspired by physics; logical approaches to relativity theory
  - hypercomputation (super-Turing), heterotic computing (hybrid models)
- Prof Marian Gheorghe (emeritus)
  - natural computing (nature-inspired); membrane computing, molecular computing
- Impact
  - Hungarian Academy of Sciences
  - thinking outside the box

Model-Based Testing

- Dr Anthony Simons
  - complete functional test generation from EFSM and IOPE models for testing Cloud services
  - automated testing of Java through dynamically inferred algebraic specifications
- Industry
  - SAP, CAS Software SA, SingularLogic, via EU FP7 Broker@Cloud; KPMG via ACRC
  - Testing-as-a-Service for the Cloud, JWalk unit testing tool for Java

Search-Based Testing

- Dr Phil McMinn (ACRC)
  - Genetic algorithms for evolutionary testing of C programs; regression testing for SQL data schemas
- Dr Gordon Fraser
  - Genetic algorithms and tools for evolutionary testing of Java systems
- Industry
  - Google, Microsoft; Costain, KPMG via ACRC
  - Testing tools IGUANA, EvoSuite, SchemaAnalyst
  - IEEE International Conference on Software Testing

Reverse Engineering

- Dr Kirill Bogdanov
  - inference of state-based models from execution traces; recovery of designs from legacy code
- Dr Ramsay Taylor
  - bidirectional model inference and test generation, state model refinement
- Dr Mat Hall (ACRC)
  - semi-supervised software re-modularisation
- Industry
  - Design inference tools StateChum, SUMO

Multi-Agent Simulation

- Prof Mike Holcombe (ACRC)
  - Flexible, Large-scale Agent-based Modelling Environment (FLAME), for HPC, Grid, GPU
  - massively parallel simulation of e.g. crowds, insect colonies, cell biology, the European economy
- Industry
  - Costain, NetworkRail, EU Commission, NHS, KPMG
  - FLAME for crowd behaviour, waste management, financial recovery, *in silico* medicine, VR sims

Software Engineering

- Dr Siobhán North
  - fast searching of distributed XML databases via sparse binary matrix indexing
  - trust-based access control, with dynamic learning
- Dr Anthony Cowling (emeritus)
  - software engineering education
  - empirical software engineering
- Impact
  - Botswana, distributed mobile phone hosting for compressed XML databases
  - ACM Computing curriculum

ACRC: www.acrc.com

Advanced Computing Research Centre

- Big Data Analytics
  - sentiment analysis; customer preferences; opinion makers; trends on social networks
  - medical analytics, discover disease connections
- Complex Simulation
  - *Oculus Rift* VR African rainforest, Blackfriars station
  - the European economy: QE versus border control?
  - *in silico* medicine: drug delivery, immunology, healing processes
- Quality Assurance and Testing
  - testing ARM mobile devices; automotive software
  - improve test suites; find rare paths