Heterotic Computing: Theory - PhD studentship
University of York, York Cross-disciplinary Centre for Systems Analysis (YCCSA)

Qualification type: PhD
Location: York
Funding for: UK citizens and EU citizens who have resided in the UK for the past three years (EPSRC eligibility requirements apply)
Duration: Funding is available for 3 years
Funding amount: Full coverage of tuition fees (at UK/EU rate) and annual stipend at RCUK rate ie £14,777 for 2018/19
Hours: Full Time

Placed on: 29 March 2018
Closes: 31 July 2018 *
* Applications may close earlier than the advertised deadline if a suitable candidate is found.

The project

We are seeking two PhD students (1 Computer Science + 1 Electronic Engineering) to join our team of researchers working on the SpInspired research project funded by EPSRC and the University of York, UK. SpInspired is developing a methodology for exploiting unconventional computing in unconventional materials such as carbon nanotubes, NMR, and liquid crystals. It is an interdisciplinary collaboration between researchers from York’s Departments of Computer Science, Electronic Engineering, and Chemistry, and the York Cross-disciplinary Centre for Systems Analysis (YCCSA).

As we approach the miniaturisation limits of conventional electronics, alternatives to silicon transistors -- the building blocks of the multitude of today’s electronic devices -- are being hotly pursued. Unconventional computing exploits unconventional material substrates within which to perform computation. Practical unconventional computing devices can comprise multiple unconventional substrates, each performing the part of the overall computation that it does best. For example, a bacterial system may be combined with an optical system to solve the ‘wiring problem’ of composing components, or a reaction-diffusion chemical system may be combined with a microfluidic droplet system to provide a range of contexts for the reactions. In even the simplest cases, an unconventional substrate is often combined
with a conventional digital computer, for example carbon nanotubes in an evolutionary algorithm loop controlled by a traditional PC.

We have developed a computational framework called Heterotic computing (named from the term in genetics meaning ‘hybrid vigour’), which can be used to extend a theory of unconventional computing to such multiple substrates.

PhD in Department of Computer Science; YCCSA

The goal of this PhD research is to formalise the theory of heterotic computing, in order to provide a means for quantifying the computation done in each substrate layer, in the various transduction processes needed to convert data representations, and in the setup and readout processes. (Many proposed hypercomputational devices neglect consideration of many of these aspects, misconcluding that the devices are more computationally powerful than they actually are, thus demonstrating the importance of accounting for all computational resources.) Additionally, the formalisation will provide a rigorous approach for designing such systems, and evaluating the computational capacity of novel substrates.

This research would suit a student with a strong theoretical computer science, physics, or mathematics background, with an interest in the theory of unconventional computing, and in interdisciplinary research.

Research supervision

If successful, you will conduct your research under the supervision of:

- Prof Susan Stepney (Dept Computer Science; YCCSA)
- Dr Angelika Sebald (Dept Chemistry; YCCSA).

https://www.york.ac.uk/yccsa/opportunities/

Award funding

If successful, you will be supported for three years. Funding includes:

- £14,777 (2018/19 rate) per year stipend
- Home/EU tuition fees
Funding requirements

To be considered for this funding you must:

- meet the entrance requirements for a PhD in Computer Science
- be eligible to pay home/EU fees and be able to meet the EPSRC requirements: [https://www.epsrc.ac.uk/skills/students/help/eligibility/](https://www.epsrc.ac.uk/skills/students/help/eligibility/)

* EU applicants who do not meet the EPSRC residency requirements can apply to be considered for a fees only award

Apply for this studentship

1. Apply to study
You must apply online for a full-time PhD in Computer Science

You must quote the project title (Heterotic Computing: Theory) in your application.

There is no need to write a full formal research proposal in your application to study as this studentship is for a specific project.

2. Provide a personal statement
As part of your application please provide a personal statement of 500-1,000 words with your initial thoughts on the research topic.

Deadline

The closing date for the receipt of applications is Tuesday, 31 July 2018. Applications may close earlier than the advertised deadline if a suitable candidate is found.

The studentship must begin in October 2018.
Informal enquiries

Project enquiries
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