

## Academic Successes



Academic awards: Fellowship of the Royal Academy of Engineering; IEEE Fellowship; Royal Society Industrial Fellowship; Royal Society International Interchange Award; and both a IEEE Fellowship and RAE Fellowship for University of Newcastle's Research Leader.



University Research Group of the Year 2015 win at the National Microelectronics Institute.



The successful graduation of 90+ PhD students; and six internships with ARM, Samsung and Intel.



Best Paper Awards at PEC 2018 in Spain, ICCES 2017 in Egypt, FCCM 2016 in USA and ICFPT 2017 in Australia (Best Presentation).



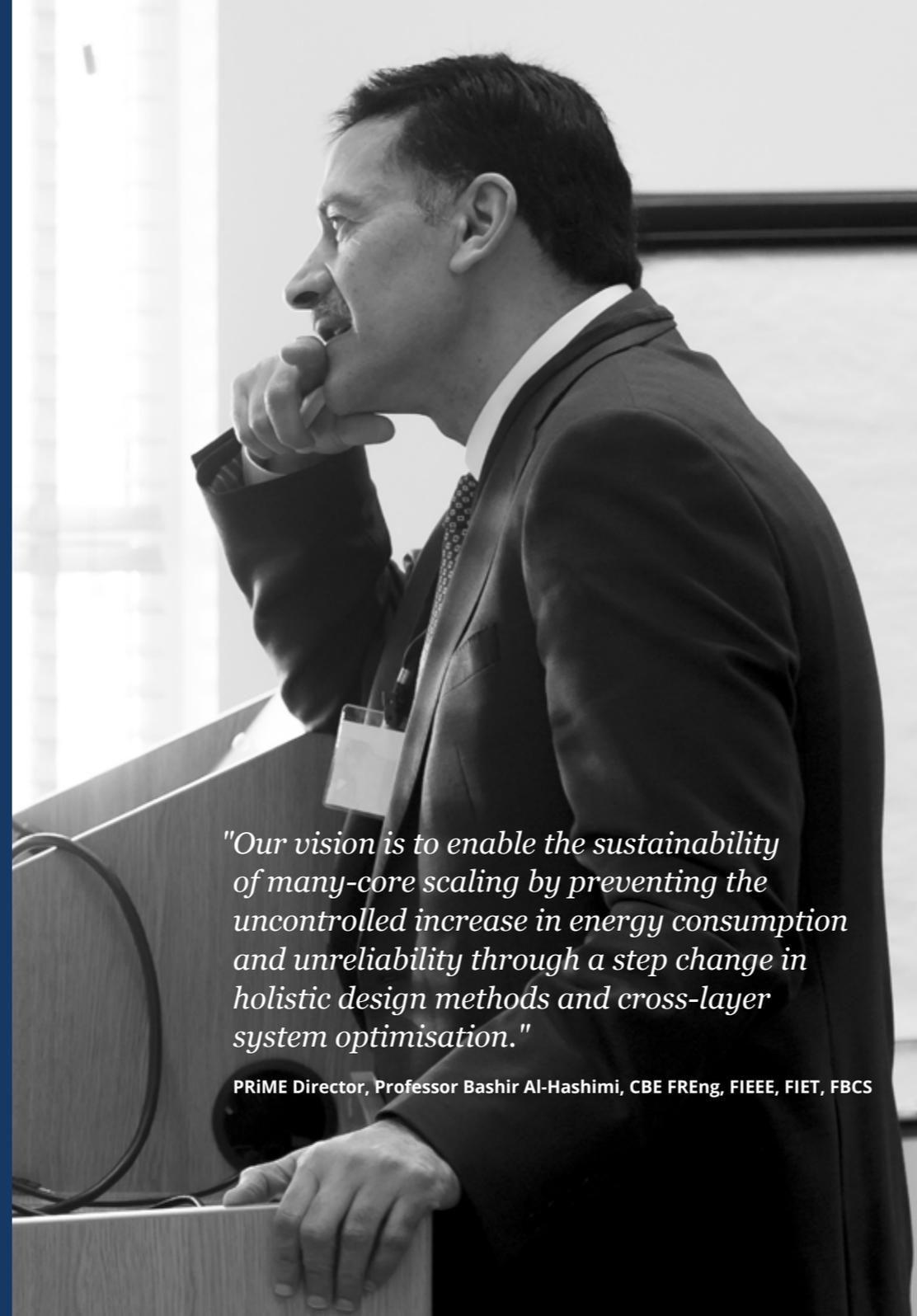
Best Presentation Award at IEEE 2017 and Best Poster Award at DATE16 in Germany.



Best Paper nominations at FDL 2016 in Germany, DATE 2015 in France and DATE 2016 in Germany (Best Interactive Presentation).

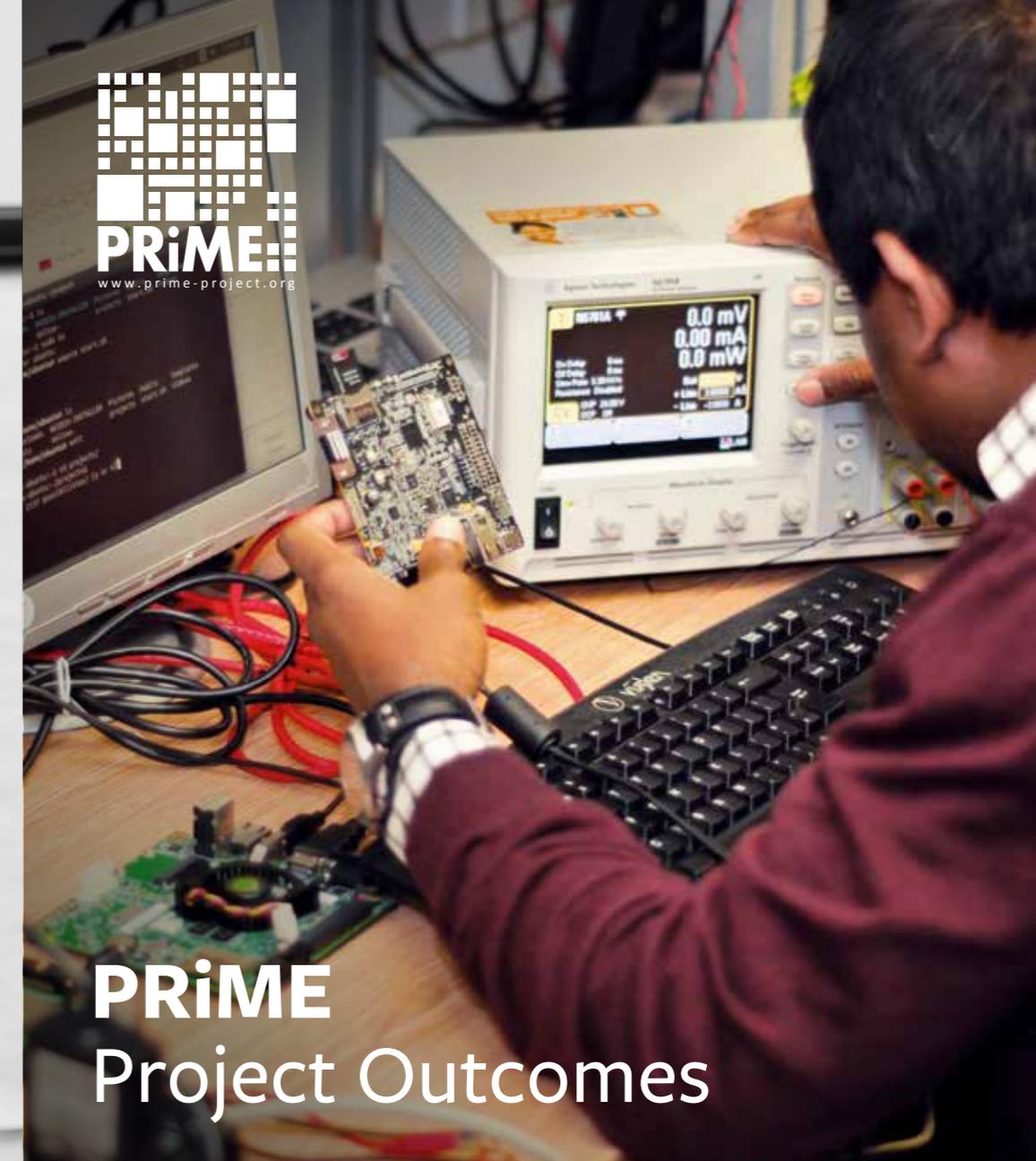


University of Southampton's Principal Investigator, Professor Bashir M. Al-Hashimi, awarded a CBE in 2018.



*"Our vision is to enable the sustainability of many-core scaling by preventing the uncontrolled increase in energy consumption and unreliability through a step change in holistic design methods and cross-layer system optimisation."*

PRiME Director, Professor Bashir Al-Hashimi, CBE FREng, FIEEE, FIET, FBCS



## PRiME Project Outcomes

UNIVERSITY OF  
Southampton

Imperial College  
London

MANCHESTER  
1824  
The University of Manchester

Newcastle  
University

arm

Imagination

intel

Microsoft  
Research

NXP

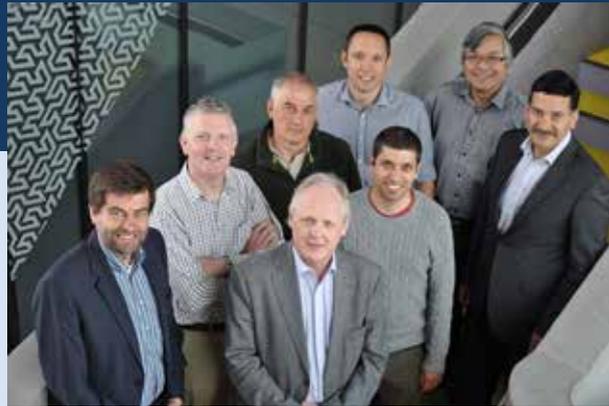
EPSRC  
Engineering and Physical Sciences  
Research Council

## PRiME Themes

The theory, algorithms, architecture and engineering challenges of:

- Theme 1 – Cross-Layer Theory and Models.
- Theme 2 – Run-Time Management and Optimisation.
- Theme 3 – Many-Core Architectures and Reconfiguration.
- Theme 4 – Platforms, Applications and Demonstrators.

With many heterogeneous cores integrated on the same chip, scalable energy reduction is highly challenging. PRiME has been a crucial project for taking the UK Many-Core research to a whole new level and has inspired the next generation of researchers to build resilience, to be more involved in cutting edge research and to contribute to the international research community and industry.



# 143

scientific publications  
to date since PRiME  
began in 2013.

## About PRiME

PRiME has been a 2013-2018 multi-million pound EPSRC funded research programme bringing together four UK universities with expertise in advanced electronics and computer systems; working in collaboration with five companies to address the challenge of power consumption, and the reliability of future high-performance embedded systems, utilising many-core processors.

# £10.4 million

in EPSRC and Industrial  
Grant funding has been  
raised based on the work  
done on PRiME.

## Exploitation of Knowledge and Open Source Tools

Throughout, a number of practically validated tools and techniques have been developed showing that step-changing gains in energy efficiency and reliability are possible using the synergy between hardware and software.

**PRiME Framework** – application and platform agnostic runtime management that enables portability of runtime management approaches

**PRiME Code Generation Tool** – a Rodin plug-in that facilitates automatic code generation of Runtime Management software from verified Event-B formal models

**PowMon** – PRiME CPU Power Modelling Tool

**PER Modelling** – PRiME's Performance, Energy and Reliability (PER) Modelling Tool

**PRiME Stereo Match** – parallel stereo matching algorithm for video depth estimation (OpenCL and C++)

**GemStone** – five software tools that together, identify and evaluate the sources of error in gem5 models against a reference hardware platform

**KOCL** – PRiME's automated tool flow for generating FPGA designs capable of accelerating OpenCL kernel execution whilst reporting their own power consumption



To download these tools, please visit:  
[www.prime-project.org/tools-and-downloads](http://www.prime-project.org/tools-and-downloads)

## Investing in the Future of our Researchers

Projects like PRiME offer a rewarding experience for researchers, as the large consortia in these projects work like incubators for nurturing ground-breaking research ideas and critical skills to develop as independent researchers. The PRiME project has enabled researchers to pursue their career goals in both academia and industry. PRiME researchers have secured senior industry positions with leading employers such as ARM, Xilinx and Intel in the UK, Belgium and the USA. Several have taken up academic posts at universities in the UK and Greece or have achieved academic promotions thanks to the skills and expertise they have developed on the PRiME Project. At least a dozen researchers will work on UKRI and EU funded projects across UK and European universities into the future, using the critical skills developed with PRiME and honing them further to continue excellent research.

## Collaborations and Knowledge Transfers

### University workshops:

- University of Warwick (TechWorks).
- University of York (UKESF).
- Hosting the International Symposium Workshop on Many-Core Computing.
- Hosting the 11th European Workshop on Microelectronic Education in 2016.
- Regularly hosting Hackathons: week long events focusing on solving a specific challenge facing the Project including OpenCL and the development of components to demonstrate the PRiME Framework.



### Industry collaboration workshops:

- International Symposium Workshop on Many-Core Computing.
- KTN Horizons 2020 CT.
- DATE2017.
- ISPASS-2016.
- MICRO-48.
- Hosting an Industry Day for 25 attendees.
- Exhibited at the Farnborough International Air Show in 2016 and in 2017.

### Research shared:

- Technical University of Dortmund.
- Nanyang Technological University of Singapore.
- University of Liverpool.
- University of Southampton – with the general public.
- Keynote speech at PATMOS.
- Introduced PRiME programme at an Energy Efficient Computing Special Interest Group Meeting.

### Exhibiting at high profile conferences:

- DATE.
- DAC.

**Visit the PRiME website:**  
[www.prime-project.org](http://www.prime-project.org)