

# TOSHIBA FELLOWSHIP PROGRAMME



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LEAD.**

The opportunity of  
a lifetime awaits



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# ➤ INNOVATION IS A JOURNEY, NOT A DESTINATION... JOIN OUR JOURNEY!



## What is the Fellowship Programme?

The Toshiba Fellowship Programme offers outstanding scientists an annual opportunity to apply to join Toshiba's research and development laboratories in Japan for up to two years, on a Research Fellowship Contract.

The Toshiba Fellowship Programme is a unique opportunity for recently qualified PhD level scientists, mainly from science, computing and mathematics disciplines. It offers a chance to journey alongside Toshiba into innovation, discovering a new world of research and development, as well as exploring and living a new cultural experience in Japan.

Toshiba Fellows nurture cross-cultural understanding between the UK, Europe and Japan whilst benefiting from working in our highly innovative and research-centred organisation, in a country renowned for its world class technology. Every Toshiba Fellow has a real possibility

to contribute to our future technologies. Participating in our scheme leads to both career development and personal growth.

The Programme has successfully operated for over 25 years, enjoying a strong and long-running collaboration with the EPSRC (Engineering and Physical Sciences Research Council) as well as fostering and developing the relationship between Japanese industry and UK academia. The successful Fellow receives a generous package, including a fixed salary and relocation assistance to and from Japan, together with support and advice prior to and during their stay.

## Would I be eligible to apply?

Candidates must:

- › Be a PhD-level researcher
- › Be of EU nationality
- › Be based in a UK academic or Government institution at the time of application (studying or working)
- › Have no more than 10 year's post-Doctoral experience
- › Have completed their PhD by the time they begin working for Toshiba in Japan.

## What would the job be like?

Toshiba Fellows usually remain in their team for up to two years. The type of work carried out depends mainly on which team the Fellow joins and the research project area.

A normal working day is standard eight hours, Monday to Friday.

So that they can settle in and feel at home in their work and a new country, Toshiba assigns a mentor to assist the Fellow in and outside of the workplace.

## Would I cope with the language barrier?

Many Fellows enjoy the experience of learning a new language skill, at the same time as the challenges of their research project work. A basic grasp of Japanese helps Fellows fully appreciate the time spent in Japan. Toshiba offers Japanese language courses to all Toshiba Fellows during the Programme. And of course, Toshiba staff also like to practice their English skills with you!

## What would I research?

Research topics and project areas generally fall into the following categories:

- › Wireless and Network
- › Human Interface and Digital Media
- › Software
- › Hardware and Mechatronics
- › LSI and Storage
- › Nano Materials and Devices
- › Systems and Environment

Applicants may also submit their own research project proposals, provided they are relevant to Toshiba's areas of interest and future technology.

## Where would I live?

Toshiba Fellows are always offered a choice between Toshiba company accommodation or

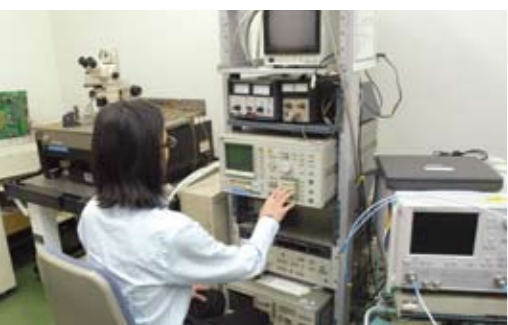
private accommodation. Toshiba supports the Fellow with advice and support to find whichever home they will feel most happy in during their stay in Japan.

## What would my stay be like?

Toshiba Fellows work in one of the Toshiba's research labs in Tokyo. The Toshiba Corporate R&D Center (RDC) is based in Kawasaki, Japan's prosperous 'Silicon Valley', located just 20 minutes from Tokyo city centre by train. Kawasaki is the prime location for advanced R&D operations for many multi-national computer and electronics companies.

As a Toshiba Fellow, you could regularly enjoy a diverse mix of cultural and leisure pursuits. There is a whole new world of temples, shrines, food, museums, theatre and shopping to discover. Peaceful lakes and shrines in Nikko are simply beautiful during the Autumn season.

Japan's land area of 1432 square miles covers a diverse geography of mountains, lakes, hot springs, forests and islands. It is the perfect environment to relax or enjoy something more active - whatever takes your fancy!



“The Toshiba Fellowship Programme is ideal for researchers with a little curiosity for Japan. The research facilities are excellent and Toshiba has excellent relations with universities, so you will probably also be in touch with researchers from Japanese universities working in your field. For me, joining the Fellowship has allowed me to move into a new area of research. Of course, the learning curve was steep, but people have been very helpful and supportive. Japan is a very different country and culture, but it is an experience of a lifetime.”

Dr Sven Meier, Water Treatment Technology, Toshiba Fellow 2007



“I love exploring the different areas around Tokyo, and the big cities further afield. Last summer I hiked up Mount Fuji, which was an amazing experience. As a snowboarder, I have taken full advantage of the fantastic snow conditions over the winter and the easy access to ski resorts. One of my most fun experiences in Japan is flying down a field of fresh powder on a crisp winter's morning in the Japan Alps...”

Dr Jamie Shotton, Computer Vision, Toshiba Fellow 2006

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## What happens afterwards?

### Future career

The Programme provides scientists and researchers a chance to stimulate their career with valuable industrial experience. It can open the door to a wide variety of employment prospects: past Fellows enjoy globally diverse careers in academia, government and industry.

### Toshiba Fellowship Alumni

A Toshiba Fellow is a Fellow for life! We operate an Alumni programme and remain in close contact with our members throughout their career. We like to maintain and nurture our links with our Alumni, establishing a contact network, exchanging information, knowledge and encouraging the networking of all Fellows. A reunion event is hosted each year, usually in London.

## How can I apply?

- › Visit the Toshiba Fellowship Programme website: [www.toshiba.eu/fellowship](http://www.toshiba.eu/fellowship)
- › Look at the current year's research topics
- › Register your interest online by completing the initial application questions
- › Eligible applications are then sent an application form
- › You must apply by sending the paper application form by the application closing deadline (as shown on the website)
- › You are also invited to attach up to two of your own research papers
- › You must also submit two references to complete your application



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# TOSHIBA FELLOWSHIP PROGRAMME RESEARCH TOPICS 2013

## Network Research Topics

### **Linearisation and efficiency improvement technologies for RF transmitters**

#### **Explanation**

The throughput and power consumption of RF transmitters are expected to be improved dramatically through digital signal processing. This programme is mainly aimed at developing, prototyping and evaluating a highly efficient transmitter (including CMOS PA) assisted by digital signal processing.

#### **Knowledge and Skills Required**

Candidates should possess expertise in constructing RF power amplifiers and in designing and using EDA (electronic design automation) tools.

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### **Research of system behaviour measurement and evaluation methods in cloud computing**

#### **Explanation**

In this programme, measurement and evaluation methods for various cloud components, such as VMs, networks, and multi-layer storage, will be studied under

the execution of various cloud applications. A cloud testbed has been prepared by Toshiba as the environment for experiments.

By taking the evaluation results into consideration, optimal cloud component control/operation methods and the optimal configuration architecture for cloud storage will be proposed, and their actual performance will be estimated.

If possible, optimal architectures for specific services will be proposed and presented through research papers (etc).

#### **Knowledge and Skills Required**

Candidates are required to have background knowledge of computer architecture, operating systems, and networking, and should be able to carry out performance evaluations on systems and networks.

Candidates are also expected to propose/verify the optimal cloud architecture through actual implementation and measurement of real test systems. Experience of implementing/operating large-scale systems would therefore be highly advantageous.

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### **Research of secure pairing-based cryptography and its application to practical systems**

#### **Explanation**

Pairing-based cryptography is expected to provide a wide variety of cryptographic protocols which have been difficult to realise. However, the difficulty of the computational assumptions related to pairing computation on which it is based are now undergoing verification.

This programme will carry out research on secure parameter settings and resolving the problems which arise when functional encryptions, which have been proposed as types of pairing-based cryptosystems, are applied to real systems.

This field of study is covered by the international conferences, CRYPTO, EURPCRYPT, ASIACRYPT, Pairing, ANTS, and ECC.

#### **Knowledge and Skills Required**

Candidates are required to have a thorough grasp of the mathematical background of number theory and elliptic curves, together with expertise in cryptology and the ability to construct cryptosystems and make cryptoanalysis.



# Media Technologies

## Research Topics

### Unified approach to automatic speech recognition and knowledge integration with adaptive learning

#### Explanation

Integrating multiple types of information, such as grammatical, acoustic, deep neural net, and duration features, into speech recognition may lead to dramatic improvements in recognition performance.

This programme is aimed at building a framework to unify knowledge and speech recognition in a statistical manner, as well as adapting acoustic and language models to different environments and topics of dialogue. The research project will involve creating novel acoustic models and language models based on machine learning, and evaluating the recognition performance for spontaneous speech and robustness against speaker variation and noise. The field of the research topic is covered by ICASSP and Interspeech.

#### Knowledge and Skills Required

Candidates are expected to possess expertise in speech recognition and statistical machine learning, and should have C/C++ programming skills.

### Medical image analysis and reconstruction

#### Explanation

This programme will include at least one of the following topics in research and development of medical image processing:

1. High-quality 3D image reconstruction algorithms, such as compressed sensing, for next-generation CT and MRI scanners.
2. High-accuracy 3D image segmentation and/or registration algorithms for quantitative imaging, such as in tumour volumetric and blood flow analysis.
3. High-efficiency 3D diagnostic image visualisation for clinical use.

#### Knowledge and Skills Required

Candidates should possess expertise in image recognition, image processing and C/C++ programming.

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### Next-generation context-aware computing

#### Explanation

This programme aims to promote globally competitive research and development into next-generation context-aware computing that accurately recognises users' activities and/or ambient situations through sensor fusion on wearable/portable devices and/or ambient sensors. The goal is to develop a novel recognition algorithm that accurately recognises situations not only on the basis of sensor signal processing, pattern recognition, and machine learning techniques, but also by creating new synergies from a combination of sensors.

We have been focusing on research and development of context-aware computing using multiple sensors. The following references provide examples of our recent results.

- K. Ouchi, T. Suzuki, and M. Doi, "LifeMinder: A wearable healthcare support system with timely instruction based on the user's context", IEICE Transactions on Information and Systems, Vol.E87-D, No.6, pp.1361-1369, 2004.
- K. Ouchi, T. Suzuki, and K. Kameyama: "Development of a wearable sleep sensor to monitor sleep states", Adjunct Proceedings of Ubicomp 2008, pp.43-44, 2008.
- K. Cho, N. Iketani, H. Setoguchi, and M. Hattori, "Human Activity Recognizer for Mobile Devices with Multiple Sensors," UIC-ATC, Symposia and Workshops on Ubiquitous, Autonomic and Trusted Computing, pp.114-119, 2009.
- K. Ouchi and M. Doi, "Living activity recognition using off-the-shelf sensors on mobile phones", Annals of Telecommunications, ISSN 0003-4347, DOI 10.1007/s12243-012-0308-9, June 2012.

#### Knowledge and Skills Required

Candidates should possess the drive to develop an exciting new frontier in context-aware computing. They should also possess expertise in sensor signal processing, pattern recognition, and machine learning with programming skills sufficient for developing algorithms and experimental systems. Moreover, it is preferable that candidates have deep knowledge of electronic hardware with the ability to design electronic circuits and develop sensor prototypes.

# Software Research Topics



## Research, development and implementation of parallel programming model

### Explanation

To maximise the efficiency and productivity of parallel programs for multi-core processors and multi-core graphic processing units (GPUs), a state-of-the-art parallel programming model including the description method, performance tuning, and debugging will be developed in this project. This model can be extended to distributed calculation environments. To this end, a parallel programming language, runtime system and libraries will be implemented and evaluated on media processing systems that use next-generation multi-core processors or GPUs, and will be applied to actual products. The field of research is expected to cover those represented by HOTPAR, PPOPP, CGO and PLDI conferences.

### Knowledge and Skills Required

Candidates should have general knowledge of computer science and parallel processing, and should preferably have in-depth knowledge of multi-core architecture, distributed systems, compiler optimisation, and runtime environment.

## Traffic flow management systems using camera data

### Explanation

This programme is aimed at developing a system which analyses information about the road obtained from security cameras or cameras installed in buses and cars, and supervises and controls traffic flow. It is expected that vehicles and/or pedestrians will be the objects of observation and management.

### Knowledge and Skills required

Candidates are expected to have expertise in data-mining techniques, or traffic simulation technology.

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# Materials and Devices Research Topics

## Application of novel discoveries in human vision to image processing and computer vision

### Explanation

This programme aims to research and develop new methods, which can improve existing semiconductor devices or realise novel devices, by analysing recently discovered functionalities in human vision from the viewpoint of image processing and computer vision. The possible investigation area includes retina (amacrine cell), LGN (lateral geniculate nucleus), V1-V2 visual cortex, and subcortical functions. The goal is to create and evaluate algorithms for image processing or computer vision which can be implemented as image sensors or recognition hardware logic. The results of the programme are expected to be applied to Toshiba's next-generation image sensors and image processors.

### Knowledge and Skills Required

Candidates are required to have expertise in image processing and computer vision, and to be open to ideas from other seemingly unrelated fields. Skills in designing image sensors or logic circuits (RTL) are desirable, but not required. Toshiba's researchers will provide support in developing the hardware implementation of the proposed algorithms.

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## Investigation of spin injection and detection in a semiconductor for spin-based MOSFET development

### Explanation

Since the successful detection of spin accumulation signals in Si at room temperature (RT), electrical spin injection and detection in semiconductors have been actively studied for realizing spin-based MOSFETs. Recently, we succeeded in observing relatively large spin accumulation signals with relatively long spin relaxation times ( $\tau=1.4$  ns) at RT (APL 100, 252404 (2012)) by using epitaxially formed CoFe/MgO electrodes on Si-on-insulator substrates with Si (100) surfaces. However, up to now, there has been almost no direct evidence for the relation between the absolute value of spin polarisation obtained by using the Hanle-type signals and the existing spin diffusion model, and the absolute value of spin polarization estimated by using non-local and local magneto-resistance (MR).

The objectives of this programme are to investigate the correlation between the ferromagnet/tunnel barrier/Si (Ge) interface structures and the absolute values of spin signals measured by using the local and non-local MR and Hanle measurement techniques, and to clarify the mechanism of spin injection and detection into the semiconductor. Our final target is to observe large local-MR, which is

important for the development of spin-based MOSFETs.

### Knowledge and Skills Required

Candidates are required to have extensive knowledge and experience of experimental methods concerning spin injection into non-magnetic materials. They are also required to have thin film deposition skills and should be interested in spin-based MOSFET research.

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## Research and development of materials for nanoelectronics using nano-fabrication by self-organisation process

### Explanation

The goal of this programme is to discover novel nano-organic memory devices of single-nanometer-scale to replace conventional non-volatile memories. The candidate should design molecules according to nano-scale electron transport and insert the molecules into a single-nanometer-scale TEG (test element group, i.e. test structure) for finding a memory function. The TEG has been fabricated with our proprietary semiconductor process using combinations of the top-down photo- and/or electron-beam lithography and bottom-up self-assembled materials.

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### Knowledge and Skills Required

Candidates should be capable of designing nano-materials or nano-devices and proposing concepts for new nano-devices. Knowledge of material physics, organic synthesis, polymer science, physical chemistry, or electronic physics is required as well as a strong interest in nano-technology.

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### Single-photon imaging for biomedical applications

#### Explanation

This research programme will study the feasibility of single-photon imaging for biomedical applications. Through the development of read-out circuit design and single-photon counting measurements, the goal of the programme is to verify the elements for prototype medical imaging equipment.

#### Knowledge and Skills Required

Candidates should possess expertise in single-photon avalanche diodes and analogue front-end circuits.

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### Chemical identification of atoms at material surface using scanning probe techniques

#### Explanation

In order to develop nano-scale devices, it will be crucial to design and control material surfaces. Specifically, in order to understand the operating principles of memory devices, that is to say, the difference between low and high resistance states, it will be necessary to identify their chemical characteristics as well as electrical and topographical (physical) properties.

This programme aims to develop a SPM (scanning probe microscopy) technique which, through conductive AFM (atomic force microscopy), can identify the chemical characterization of a single atom on the top surface of one conduction path of a memory device.

#### Knowledge and Skills Required

Candidates are required to have expertise in surface analysis techniques, especially with regard to the use of scanning probe microscopy. It is preferable that they also have experience with computational simulations for data analysis.

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## Other Research Topics

**Proposals from applicants for new advanced research topics which are relevant to this year's Toshiba Fellowship Programme research areas are also welcome**

#### Explanation

Toshiba appreciates such proposals and will determine their acceptability based on the current circumstances of Toshiba's R&D activities.

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