RESEARCH SPOTLIGHT:
TELEPORTATION NOW A VIRTUAL REALITY

With the flick of a single switch, you can travel instantly to a remote location for a meeting with colleagues in other parts of the world. Or flick the same switch and you can be rubbing shoulders with other fans at a BTS concert at Wembley Stadium.

This is the potential of augmented virtual teleportation (AVT), a new technology being developed by researchers at the Computational Media Innovation Centre (CMIC) that enables remote telepresence.

Remote virtual reality (VR) 'travellers' are teleported to where the augmented reality (AR) hosts are located to interact in a shared augmented environment. Travelling, in this case, is achieved by blending AR and VR technologies with the use of 360-degree video and live streaming to combine virtual objects with live video in real time.

Centre director Associate Professor Taehyun Rhee says, "We use high-fidelity computer graphics with AR technology to seamlessly blend virtual objects into the shared space. This makes it possible for individuals to communicate, collaborate, and exchange knowledge and ideas across any distance, as though they were in the same location.

"It will unlock the power of teleportation in a digital way, allowing distant people to come together to travel, work, learn, and play in a way that we have not yet experienced."

With AVT successfully eliminating the barrier of distance, the technology becomes relevant to a range of industries, from classrooms to field trips and films to live events.

"We may feel that we can't get the true taste of a culture unless we actually travel to that specific region, but with AVT, it's possible for a person to sit in a living room in Seattle and virtually do one of the great walks in New Zealand," he says. "You can be fully immersed in the space and communicate with people there."

Dr Rhee and his team are passionate about enabling people to form connections and believe AVT offers a new method for digital connection between people around the world who may otherwise be unable to meet. The global adoption of 5G will expand the potential for AVT. It will enable the augmented environment to appear even more real and have the quality to match human perception and cognitive thresholds.

Because industry is the key rationale behind CMIC's cutting-edge research, the centre hosts an incubation space where staff can prototype their ideas. By focusing on innovative, user-oriented academic research, CMIC aims to be a key part of the growth story of New Zealand's interactive media ecosystem.

Faisal Zaman's life changed in 2016 when he put on a cardboard VR headset for the first time.

"I was really excited about the scope of research in this field and wanted to explore different aspects of AR and VR technologies such as data visualisation, remote collaboration, and immersive analytics. You just have to look around to see how AR and VR have influenced the way we work, even during tough times like the pandemic," says Faisal, who is a doctoral candidate studying multi-user extended-reality collaboration for high-fidelity telepresence.

"But there is an opportunity to make the technology even more relevant to real-world needs. The Centre showcased some truly path-breaking work in AR and VR at the SIGGRAPH Asia conference in 2018, and this is one of the key factors that influenced my decision to come here.

"This is a great environment for research and collaboration. My colleagues are very friendly, and we all have access to some of the latest VR gadgets and the space to experiment with new ideas," he says.

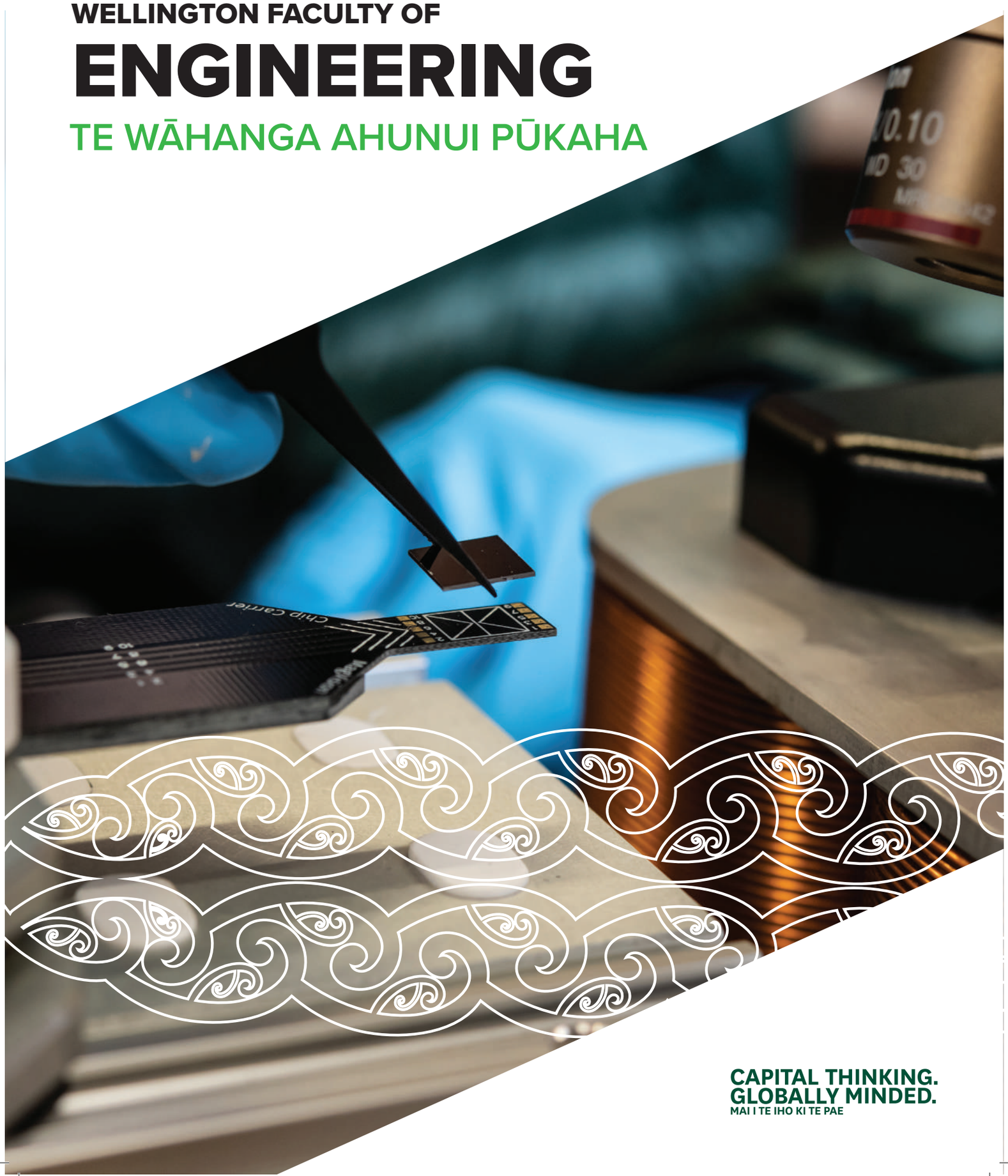
2022
POSTGRADUATE
STUDY

VICTORIA UNIVERSITY OF
WELLINGTON
TE HERENGA WAKA

WELLINGTON FACULTY OF

ENGINEERING

TE WĀHANGA AHUNUI PŪKAHA



CAPITAL THINKING.
GLOBALLY MINDED.
MAI I TE IHO KI TE PAE

“Wellington has its own distinct character that comes from the diversity of the people here, and it allows you the freedom to carve your own identity. And working at the University’s Robinson Research Institute is a great experience as the topics we research here can impact the world at large.”

Dr James Storey
Senior Scientist
Paihau–Robinson Research Institute

CONTENTS

QS STARS™ RATING SYSTEM

Te Herenga Waka—Victoria University of Wellington has been awarded five stars plus overall in the QS Stars university ratings system. In addition, the University received five stars in all eight categories on which it was evaluated.

WELCOME

Do you want to make the next major breakthrough in technology, create devices that save lives, or help build the next blockbuster film? Are you someone who thrived on the challenge of undergraduate study? Do you want to push yourself to become an expert in your field?

If so, welcome to the Wellington Faculty of Engineering—where we have a range of postgraduate opportunities for you.

Te Herenga Waka—Victoria University of Wellington is New Zealand's number-one-ranked research university, and our professors lead world-class research in a number of areas: artificial intelligence, computer graphics, cybersecurity, mechatronics, software engineering, and renewable energy. Postgraduate research in our Faculty allows you to work with, and learn from, experts in the field who are constantly extending the boundaries of modern engineering knowledge.

The Faculty prides itself on its collegiality and support systems for postgraduate students. Our experienced, international staff are passionate about supporting students to follow their natural curiosity into new areas of study and research. We also have close collaborative ties with researchers in other schools at the University, such as Design, Mathematics and Statistics, Music, and Psychology, all of which foster exciting, high-impact research.

Wellington is a city buzzing with development in the ICT and technology sectors, driving an industry that is constantly changing. The Faculty has established links with leading businesses and sought-after professionals locally and internationally, including Google, Weta Digital, and Xero. Whether academia or industry is your goal, we have the connections to help you get there. Our alumni pursue amazing careers all over the world.

We offer a full range of postgraduate courses across the School of Engineering and Computer Science, the Computational Media Innovation Centre, the Paihau—Robinson Research Institute, and the Wellington ICT Graduate School. The courses are either taught or research based, one year or three years in length, industry or academically focused, and for those with prior technology experience or without. See what we have to offer, and set yourself up for a rewarding, enjoyable future where you can make a real difference.

Noho ora mai.

Professor Dale Carnegie
Dean of Engineering

STUDYING AND LIVING IN WELLINGTON

LIFE ON CAMPUS

Te Herenga Waka—Victoria University of Wellington has three city campuses: Kelburn, Pipitea, and Te Aro. The Faculty also has two off-campus research centres, one in Wellington city and the other in Lower Hutt. The Kelburn campus is the centre of student experience, with lively social spaces in the Hub where you can catch up with study, grab a coffee, eat lunch, or hang out with friends.

Everything you need is on campus—there's a good choice of cafés, a bookshop, pharmacy, and money machine, as well as the Adam Art Gallery, an award-winning building housing a changing programme of exhibitions. The campus also includes a new, state-of-the-art science block.

LIFE IN WELLINGTON

Wellington is a beautiful city that makes the most of its natural surroundings. It's compact and easy to get around. You can walk just about anywhere, or ride our great public transport system. In just minutes, you can escape the city to explore miles of coastline, take a walk in native bush, or relax on sandy beaches. By studying at Te Herenga Waka—Victoria University of Wellington, you will become part of the diverse and friendly community of our thriving capital city.

LIVELY, CREATIVE CAPITAL

Wellington has something for everyone, with great shopping, beaches, mountain bike trails, galleries, museums, restaurants, and the best café culture in the country. Head to the coast, just a short drive from the city, to swim, surf, or sail. Enjoy the vibrant nightlife of the central city and check out the night markets, festivals, and theatre and live music shows every night of the week.

CAPITAL THINKING

Come and experience the benefits of the University's strong connections with government, business, and the country's top scientific, cultural, and creative organisations.

As the capital city, Wellington is home to many national organisations and treasures, including Parliament, Te Papa Tongarewa, the Supreme Court, the National Library, Zealandia, and the New Zealand Film Archive, as well as the highest concentration of science organisations in New Zealand.

MAKING CONNECTIONS

The University operates at the interface between business, innovation, and regulation. We have strong connections with political, public sector, legal, diplomatic, cultural, scientific, corporate, community, media, and non-governmental organisations.

Our capital city connections mean students have excellent opportunities for part-time work, volunteering, and internships, as well as networking for jobs once they graduate.

GLOBALLY MINDED

Come and be part of a truly international community right in the heart of our thriving capital city. Our programmes and research focus on New Zealand, the Asia–Pacific region, and the world.

AWARD-WINNING EDUCATORS

Teaching staff who care about your future will help make your time at the University a success. Most courses include tutoring in small groups, where you can discuss your ideas, ask questions, and get individual help. A number of our staff have won awards for innovative teaching.

CHOICE AND FLEXIBILITY

We pride ourselves on giving our students freedom to choose their own path through study. University is a time to explore your interests and discover where your passions lie.

SCHOOL OF ENGINEERING AND COMPUTER SCIENCE

If you want to take the next steps in your professional career in the hi-tech industry and research community, you'll find a warm welcome and a supportive and stimulating environment in the School of Engineering and Computer Science at Te Herenga Waka—Victoria University of Wellington.

Our focus on digital technology will provide you with all the skills and experience you will need in the modern workplace and research labs.

LEARN FROM, AND ALONGSIDE, THE BEST

Our highly experienced, international staff have wide networks in research and industry and are actively engaged in internationally recognised, ground-breaking research here at New Zealand's number-one-ranked university for research.

Not only are our researchers constantly extending the boundaries of modern engineering and computer sciences, they are passionate about supporting students to follow their curiosity into new areas of study and research.

As New Zealand's capital city university, we enjoy the benefits of a wonderful landscape and lifestyle, contacts and collaborations with government, national research funders, and world-class industry. We are a School that prides itself on its collegiality and multidisciplinary collaborations with many international and local top-ranked research clusters.

Our research groups provide a collaborative and encouraging support network, and our postgraduate students regularly present their work at prestigious conferences.

CUTTING-EDGE FACILITIES

Our postgraduate students have access to state-of-the-art equipment and laboratories, situated at NEC House in the central city and in the Alan MacDiarmid, Cotton, and Maru buildings on the University's picturesque Kelburn campus, with enviable views over the city and Wellington harbour.

STUDY OPTIONS

We offer a range of postgraduate study options suited to your interests and ambitions—from coursework-based degrees that allow you to learn in a structured environment from knowledgeable and world-leading staff to thesis-based options where you will have the opportunity to join, and contribute to, established research projects, or follow your own interests and forge a new path. Our future-focused postgraduate qualifications see our graduates placed at the forefront of an exciting growth industry.

RESEARCH GROUPS AND CENTRES

We have a number of established research hubs that you can join as a postgraduate student, from smaller informal groups that are working collaboratively to extend the boundaries of our knowledge in key areas to larger industry-linked research centres that offer opportunities for supervision—see the Faculty's research centres on the following pages.

RESEARCH CENTRE
COMPUTATIONAL MEDIA INNOVATION CENTRE

One of the University's newest research centres, the Computational Media Innovation Centre, was launched in 2018 with the aim of strengthening New Zealand's capability in immersive, interactive, and intelligent (3I) media technologies through transformative research.

The Centre incubates potential tech start-ups, thereby establishing an entrepreneurship pipeline for technology transfer and placing it at the forefront of an emerging market. It has also developed links with a variety of renowned international companies and institutes to implement a pathway to deliver future media platforms and services. These platforms and services are aimed at advancing anime, digital simulation and training, film visual effects, gaming, media interfaces and devices, and virtual and augmented reality.

In early 2019, it moved into new premises in downtown Wellington. The space has been custom designed to support cutting-edge research, industry collaboration, process innovation, and a high-quality student experience.

RESEARCH AREA

Our research expertise spans computational science, including artificial intelligence, computer graphics, computer vision, computational simulation, machine learning, and virtual and augmented reality.

Technological innovation for immersive, interactive, intelligent media platforms, the study of new user experiences, and media interfaces are at the heart of what we do. We are pushing the boundaries of what's currently possible in the realm of 3I media.

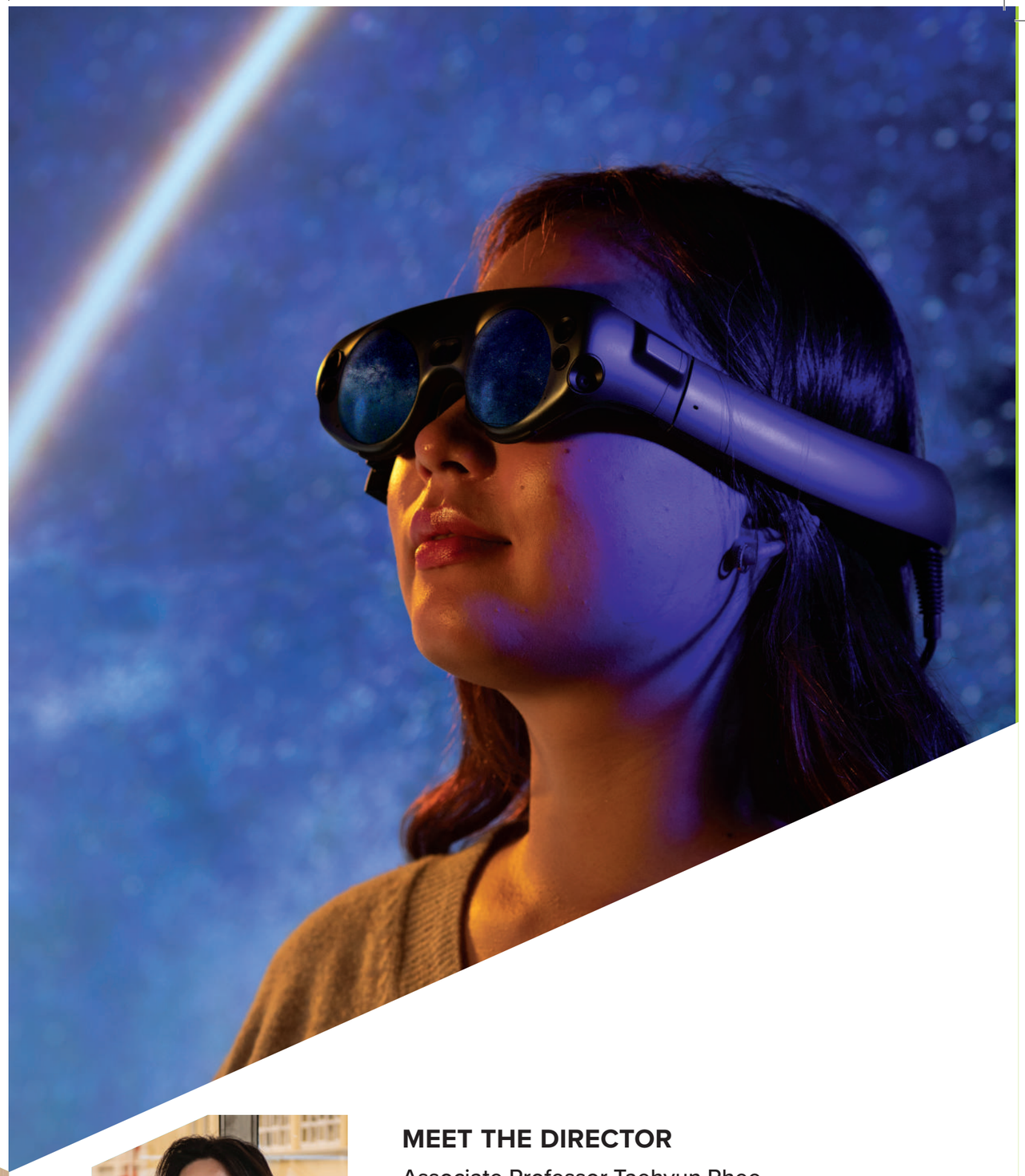
INDUSTRY COLLABORATION

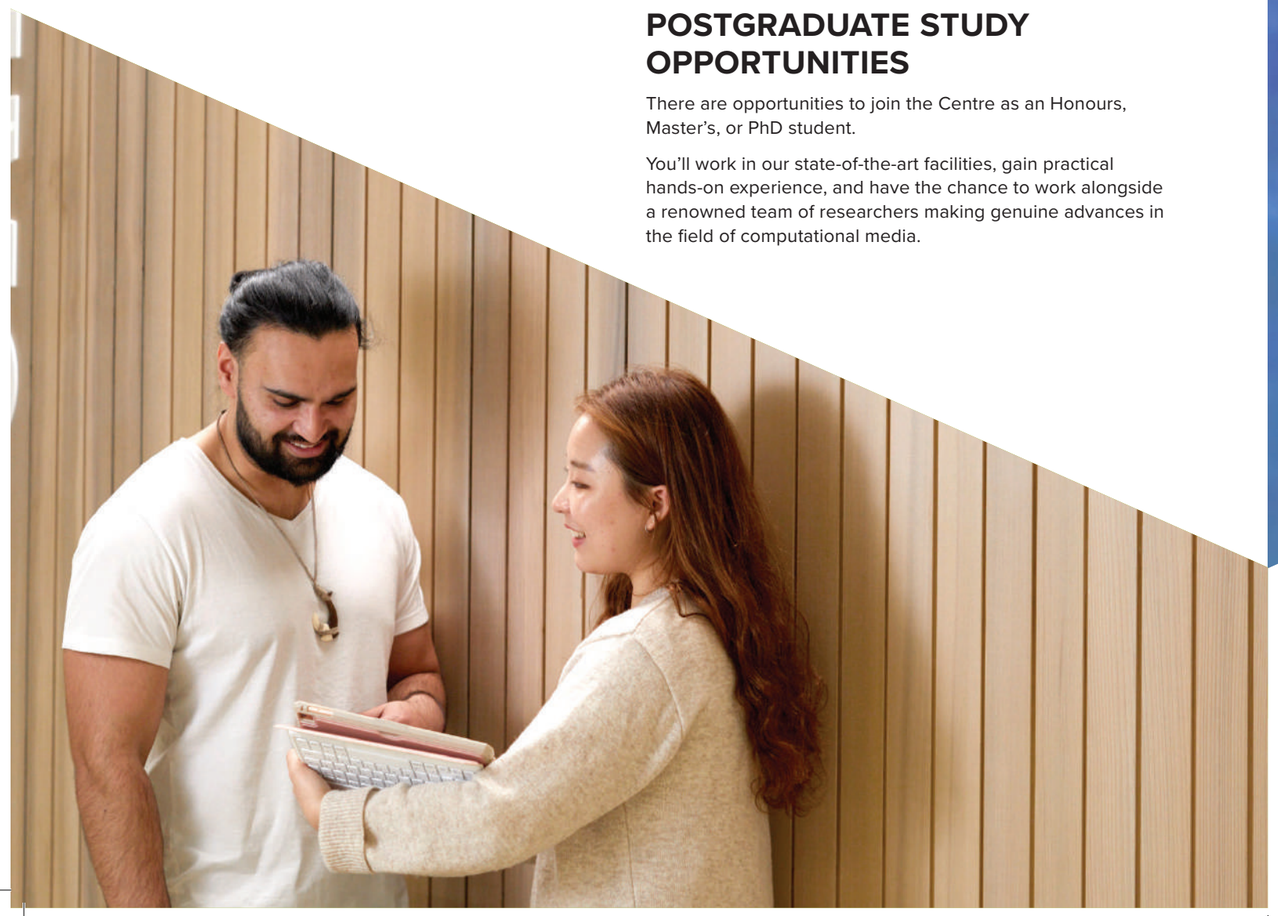
We undertake research with national and international partners to develop a pathway from research to industry application. Our goal is to strengthen and enhance the links between academia and industry, advance 3I media technologies, and deliver the global impact of research findings discovered here in New Zealand.

POSTGRADUATE STUDY OPPORTUNITIES

There are opportunities to join the Centre as an Honours, Master's, or PhD student.

You'll work in our state-of-the-art facilities, gain practical hands-on experience, and have the chance to work alongside a renowned team of researchers making genuine advances in the field of computational media.





MEET THE DIRECTOR

Associate Professor Taehyun Rhee

Associate Professor Taehyun Rhee is the founder of mixed reality start-up DreamFlux, founder and director of the University's computer graphics lab, and founding member of the Computer Graphics programme, established in collaboration with Weta Digital. Before joining the University, he held roles at Samsung, including as a principal researcher and leader of computer graphics and medical physics. He won the Baldwins Researcher Entrepreneur Award at the KiwiNet Research Commercialisation Awards 2018.

RESEARCH CENTRE

PAIHAU—ROBINSON RESEARCH INSTITUTE

The Paihau—Robinson Research Institute is recognised worldwide as a pioneer and leader in high-temperature superconductivity (HTS) research and application. The immersive environment offers our students the opportunity to learn from and interact with the world's leading experts and companies, making our graduates highly sought after by global industry. Our alumni are leading figures in transnational high-technology companies. With applied superconductivity laboratories that are among the best equipped in the world, our research programme encompasses a range of projects in electromagnetic technologies and materials science and engineering, which are typically supported by either government or industry investment.

Our multidisciplinary research team brings together expertise in innovative engineering, applied physics, and materials science to research, build, and commercialise advanced technologies with partners, both internationally and within New Zealand.

COLLABORATIVE RESEARCH

Collaboration drives much of our research. We work with world-leading researchers from both academia and industry, combining our science and engineering expertise to solve problems and develop new high-value products. These research partnerships are wide-ranging, from fusion, space technologies, and high-speed rail through to new applications for magnetic sensors and creating better energy-storage devices.

- Superconducting power systems: Our work on ultra-efficient aircraft, trains, wind turbines, flywheels, generators, compact fusion technologies, and transformers is helping to reduce energy waste and creating renewable energy solutions.
- Magnet systems: The magnet group developed the very first high temperature superconducting MRI system. They develop cryogen-free superconducting magnet systems for magnetic resonance (MRI/NMR) and other applications that enable next generation portable, rapidly deployed, and ultra-precise healthcare solutions.
- Magnetic sensors: Magnetic sensors have myriad uses, from infrastructure inspection to traffic management. Our industry-led research is exploring cutting-edge new applications.
- Space technologies: We are at the forefront of delivering a step change in space-propulsion using ultralight, sustainable, and efficient superconducting systems. We are developing the next generation of satellites, utilising HTS technologies that will enable the space industry revolution.
- Fundamental science: Our materials physics team undertakes fundamental research into novel electronic systems—superconductors, spintronics, and hybrid materials. This underpins and guides several of our industrial research programmes.
- Zero-CO_2 metals: Metal production is the world's largest industrial source of carbon dioxide (CO_2) emissions. Our materials team is developing new chemical processes to eliminate CO_2 emissions from the production of industrially essential metals such as iron and vanadium.

POSTGRADUATE STUDY OPPORTUNITIES

We welcome students from universities and technology institutes around the world.

Our Master's and PhD projects are based around our existing applied and fundamental research programmes. Research projects are tailored to the skills and needs of an individual student and span mechanical, mechatronic, and electrical engineering; physics; and materials science and engineering.

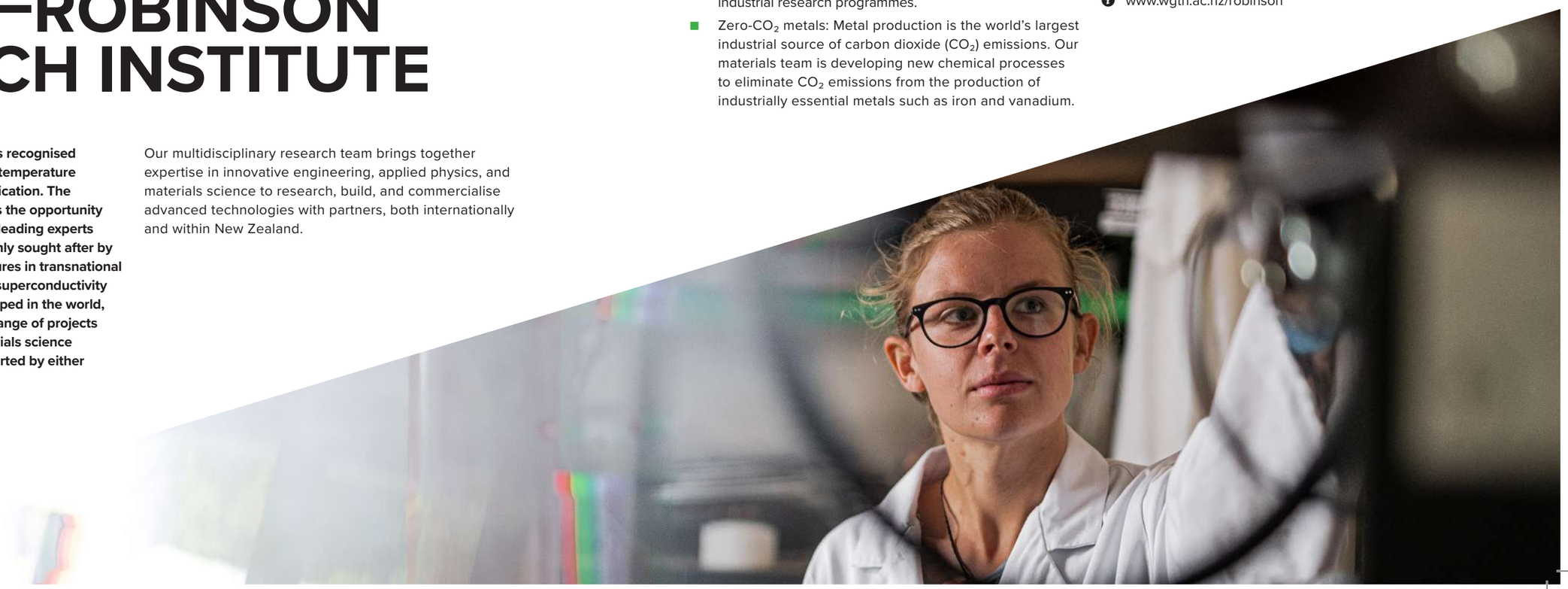
As a postgraduate student with us, you'll be an integral part of our project teams and experience a mix of practical problem-solving and academic learning, working alongside our world-class scientists and engineers.

Students undertake real discovery work and make genuine scientific and engineering advances, which make it possible for industry to develop new products and processes. The superior practical experience we offer students is highly sought after by employers in New Zealand and overseas who are looking for graduates with practical skills in engineering implementation as well as recognised academic qualifications.

Graduates who have studied with us often find their experience in project management sees them advance to leadership positions within industry and the research community. Master's and PhD students can apply to study within any of the disciplines pursued at the Institute. Scholarships are available through the Wellington Doctoral Scholarship scheme, and other funded project scholarships may also be available. Check our website for up-to-date details.

Email Dr Chris Bumby or Dr Sergei Obruchkov at rri-postgrad@vuw.ac.nz for more information.

www.wgtn.ac.nz/robinson



WELLINGTON ICT GRADUATE SCHOOL

The Wellington ICT Graduate School is an initiative led by Te Herenga Waka—Victoria University of Wellington to create direct pathways from education into employment. We partner with local technology businesses to provide guest lectures, workshops, mentorships, and projects for our students so they can gain the experience needed in real-life work environments. Some of our partners include ANZ, Catalyst IT, Chorus, the Ministry of Education, Spark, Wellington City Council, and Weta Digital.

Everyone has to start somewhere and have their own personal career journey. We recognise this and build upon people's existing talents and skills. Some of our postgraduate programmes are 'conversion' programmes, meaning they are created for people from non-ICT backgrounds. Open to anyone with a Bachelor's degree or equivalent experience, they allow people to change career directions without having to start from scratch.

Our students come from varied backgrounds, from veterinarians to linguists and musicians, who are now expanding their skill sets. Not only do we offer industry-relevant experience and fast-tracked learning of highly sought-after technical skills, we also offer professional development opportunities. We have a 92 percent graduate employment rate within a year, relevant to the graduate's area of study.

There is a huge demand for people to fill ICT roles in Wellington, and IT roles dominated the list of highest paid positions in 2019. Business analysts, developer programmers, software testers, web developers, and ICT project managers are on the skill shortage list. These are some roles that our programmes target.

With the recently inaugurated campus located in the heart of Wellington, our purpose-built new space has the latest technology and a range of workspaces that encourage collaboration and innovation while providing flexibility. Our postgraduate programmes often collaborate, and students learn from each other on group projects. This is a meaningful opportunity to learn from different disciplines and experience what working in the industry feels like.

PROGRAMMES OFFERED

Master of Software Development

Learn how to program applications, including topics about Java, data structures, version control, networking, databases, security, web systems, Agile, and artificial intelligence.

Master of Design Technology

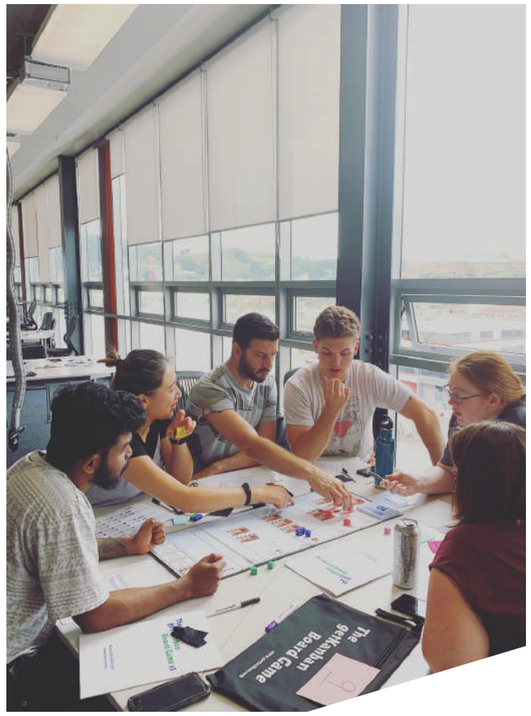
Learn how to create time-based media using 3D software to tell interesting stories that could include visual effects, gaming, animation, and extended reality.

Master of Professional Business Analysis

Learn how to identify problems and improve processes for businesses with topics about systems analysis, databases, project management, and enterprise architecture.

Master of User Experience Design

Learn how to improve customer interactions with topics about persona development, case study analysis, user interface design, rapid visualisation, and prototyping.



PROGRAMMES OF STUDY

The table below offers a comprehensive overview of postgraduate study options offered by the Wellington Faculty of Engineering.

Qualification	Duration	Trimester start	Type of programme	Entry requirements
Graduate Diploma in Science (Computer Graphics, Computer Science, Electronic and Computer Systems)	Up to 2 years	1, 2, 3 depending on background	Coursework	Bachelor's degree or equivalent
Postgraduate Certificate in Science (Artificial Intelligence, Computer Graphics, Computer Science, Electronic and Computer Systems)	1 trimester	1, 2	Coursework	Bachelor's degree or equivalent in a relevant subject area with at least a B average
Postgraduate Diploma in Science (Artificial Intelligence, Computer Graphics, Computer Science, Electronic and Computer Systems)	2 trimesters	1, 2	Coursework	Bachelor's degree or equivalent in a relevant subject area with at least a B average
Bachelor of Science with Honours (Artificial Intelligence, Computer Graphics, Computer Science, Electronic and Computer Systems)	2 trimesters	1, 2	Coursework + research project	Bachelor's degree or equivalent in a relevant subject area with at least a B+ average in subject area at 300 level
Master of Science (Artificial Intelligence, Computer Graphics, Computer Science, Electronic and Computer Systems)	2 years	1, 2	Coursework	Bachelor's degree or equivalent in a relevant subject area with at least a B+ average in subject area at 300 level
Master of Engineering by thesis	1 year	Anytime	Thesis + optional coursework	Honours degree or equivalent in a relevant subject area with at least a B+ average
Master of Science by thesis	1 year	Anytime	Thesis	Honours degree or equivalent in a relevant subject area with at least a B+ average
Master of Artificial Intelligence	12–16 months	1	Coursework + research project	Bachelor's degree or equivalent in computer science or relevant subject area with at least a B average
Master of Computer Science	12–16 months	1, 2	Coursework + project	Bachelor's degree or equivalent in a relevant subject area with at least a B average
Master of Engineering Practice Includes industry placement or applied research project	12–16 months	1	Coursework + project/internship	Bachelor's degree or equivalent in a relevant subject area with at least a B average
Master of Software Development Includes industry placement or applied research project	1 year (full time only)	2	Coursework + internship	Bachelor's degree not in computer science or related topic, with at least a B average. Basic level of competence in programming required
Doctor of Philosophy (PhD)	3–4 years	Applications due 1 March, 1 July, 1 November	Thesis	Honours or Master's degree with at least B+ average or equivalent

The period indicated is the minimum duration. Part-time study will require longer to complete the qualification.

POSTGRADUATE PROGRAMME IN ARTIFICIAL INTELLIGENCE

The Wellington Faculty of Engineering offers New Zealand's first postgraduate programme in Artificial Intelligence (AI) to equip graduates with advanced knowledge of concepts and techniques in AI.

At a time when AI techniques are being increasingly adopted to address various problems, you will gain advanced knowledge of the concepts and techniques that power AI. You will also acquire the skills to build AI tools for a range of applications that have the potential to solve real-world issues.

Join the team at New Zealand's top university for high-intensity research that is defining the future of AI research.

ENTRY REQUIREMENTS

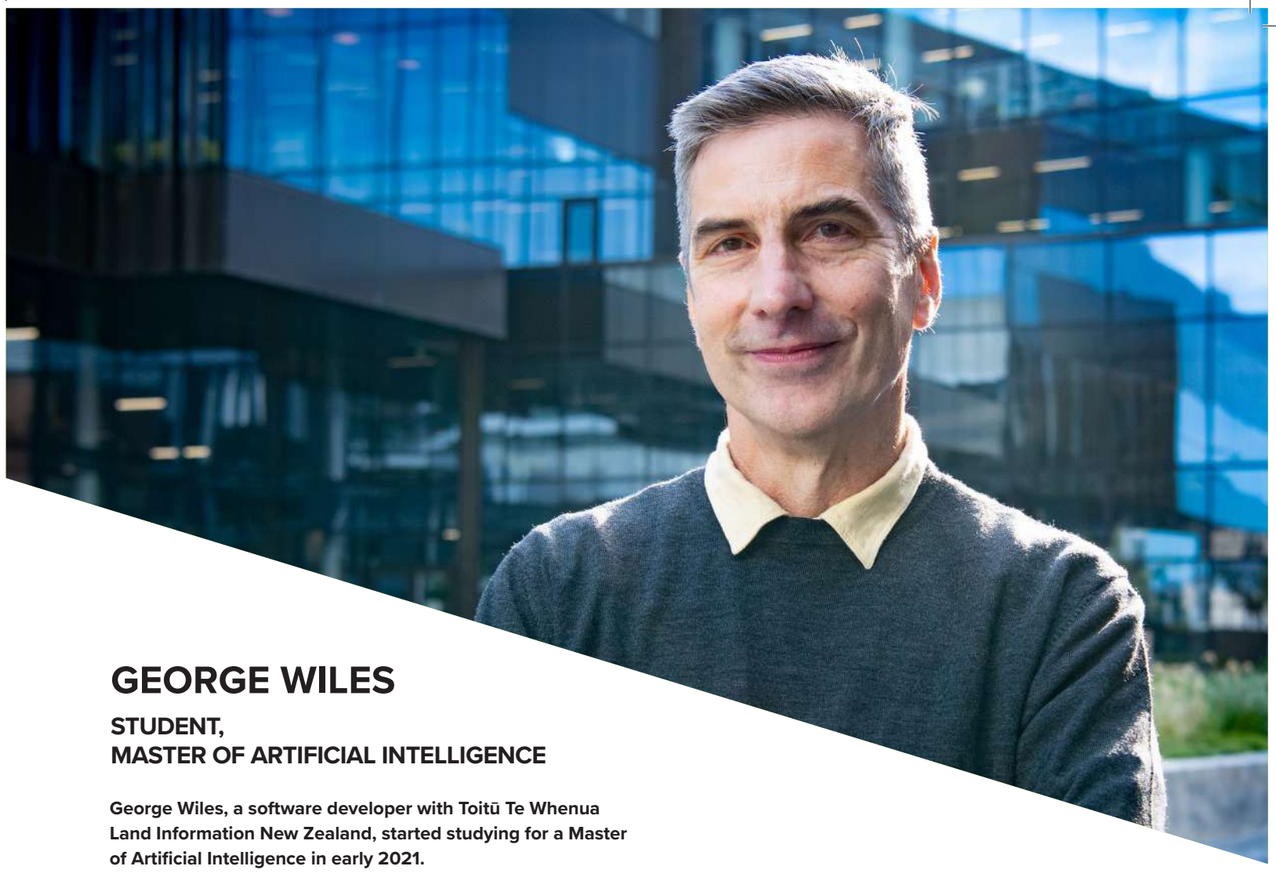
To be accepted into this programme, you will need a Bachelor's degree or equivalent in computer science or relevant subject, with at least a B average.

Degree programme	Duration	Points for qualification	Programme structure	Suitability
Postgraduate Certificate in Science in Artificial Intelligence	1 trimester or more if part time	60	• Four 400-level courses	For those who are employed and seek skills and knowledge in this field This could feed to an MAI/MSc degree
Postgraduate Diploma in Science in Artificial Intelligence	1 year	120	• Eight 400-level courses OR • Five 400-level courses and a research project	For those seeking a strong foundation in AI and a pathway to further study
Bachelor of Science with Honours in Artificial Intelligence	1 year	120	• Five 400-level courses • Research project	For those seeking a strong foundation in AI and a pathway to further study
Master of Artificial Intelligence	12–16 months	180	• Eight 400-level courses • Research project	For those wanting to enhance career prospects by engaging intensely with the subject
Master of Science in Artificial Intelligence	2 years	240	• Eight 400-level courses • Master's thesis	For those keen on exploring the subject in depth; pathway to doctoral study

Note: International students cannot enrol in postgraduate certificate programmes due to visa requirements.

"AI is currently considered as key to driving innovations in major economies around the world, in research as well as industry. Te Herenga Waka—Victoria University of Wellington's postgraduate programme in Artificial Intelligence is the first one of its kind that is being offered in New Zealand. It is aimed at individuals from diverse backgrounds with varying levels of experience, and graduates can pursue a range of options across public and private sectors. Studying AI at Wellington's university will offer students the opportunity to learn from, and interact with, leading researchers and academics."

Professor Mengjie Zhang
School of Engineering and Computer Science



GEORGE WILES

STUDENT, MASTER OF ARTIFICIAL INTELLIGENCE

George Wiles, a software developer with Toitū Te Whenua Land Information New Zealand, started studying for a Master of Artificial Intelligence in early 2021.

"I've been working in the software development side of things for quite a long time because I enjoy the creativity of building things and creating services that hopefully have a positive experience. One of the main reasons I started this degree is my interest in this field—the potential that artificial intelligence [AI] and big data have to impact our everyday lives," he says.

Formerly from Auckland, George moved to Wellington in 2000 to join his brother Robert, who received funding for an innovative IT start-up using personal domain names as a social networking tool. "I found Wellington very interesting. I liked how everything was so close that you could walk and cycle across town. The city was wired with high-speed infrastructure, and I decided to stay on."

He began his long-term adventure with learning when he was in Auckland. "Initially working as a motorcycle courier and building pre-nail construction, I did some programming courses out of interest at Auckland Institute of Technology, which introduced me to C++. My first job was for a multinational market research company writing software with a small team, analysing raw data sourced from all the supermarket chains in New Zealand to investigate buyer behaviour. I was sent to Japan on two occasions to assist with the port of our software to kanji and katakana. My career started to take off with work in the telecommunication and banking sector, when I was involved in the launch of ASB's BankDirect initiative, after which I worked with Computershare offshore in Sydney to replace the NZSE trading system.

"Having found something I was passionate about, I completed a Bachelor of Science and a Diploma in Business (IT) to broaden my skills. With this Master of Artificial Intelligence, I guess you could say that my education has been slowly accumulating incrementally."

Attending university-hosted sessions with his daughters when they were researching their own study options offered George an insight into the variety of study areas he could explore. "Seeing my daughters succeed in civil engineering and physics degrees, and listening to various universities talk about the degrees and courses they offered, reignited my curiosity about the future, and I found the University's Computer Science presentation particularly engaging," he says.

"I also find the questions around the ethics of using AI very relevant. There are the positive sides of using AI in healthcare and ecosystem modelling, but also very negative examples such as Cambridge Analytica's use of personal information to influence people by targeting voting behaviour, and how important it is that people are made aware of these sorts of issues."

Speaking about his experience of being a Master of Artificial Intelligence student, George says, "I really enjoy being back in the classroom and having the opportunity to be part of conversations. Some of the students in the 400-level classes are working on some unique projects in neural networks and natural language processing.

"I'm very happy with my career choice and I believe growth is about continual and incremental learning. As someone who likes to give 100 percent to anything I do, I'm still learning to balance part-time study and full-time work. And it's helpful to know that there are others navigating the same sort of challenges."

MASTER OF COMPUTER SCIENCE

Study emerging technology, explore concepts that will form the foundations of future innovations, and enhance your career with a Master of Computer Science (MCompSc).

This flexible coursework- and project-based programme will put you at the forefront of innovation in a rapidly developing industry.

You'll gain specialist knowledge of computer science theories, methods, and strategy and build on your skills in computing architecture, construction, engineering, and design.

Examine networks, software, tools, and packages, and learn more about a range of programming languages and computer-based systems.

DEGREE STRUCTURE

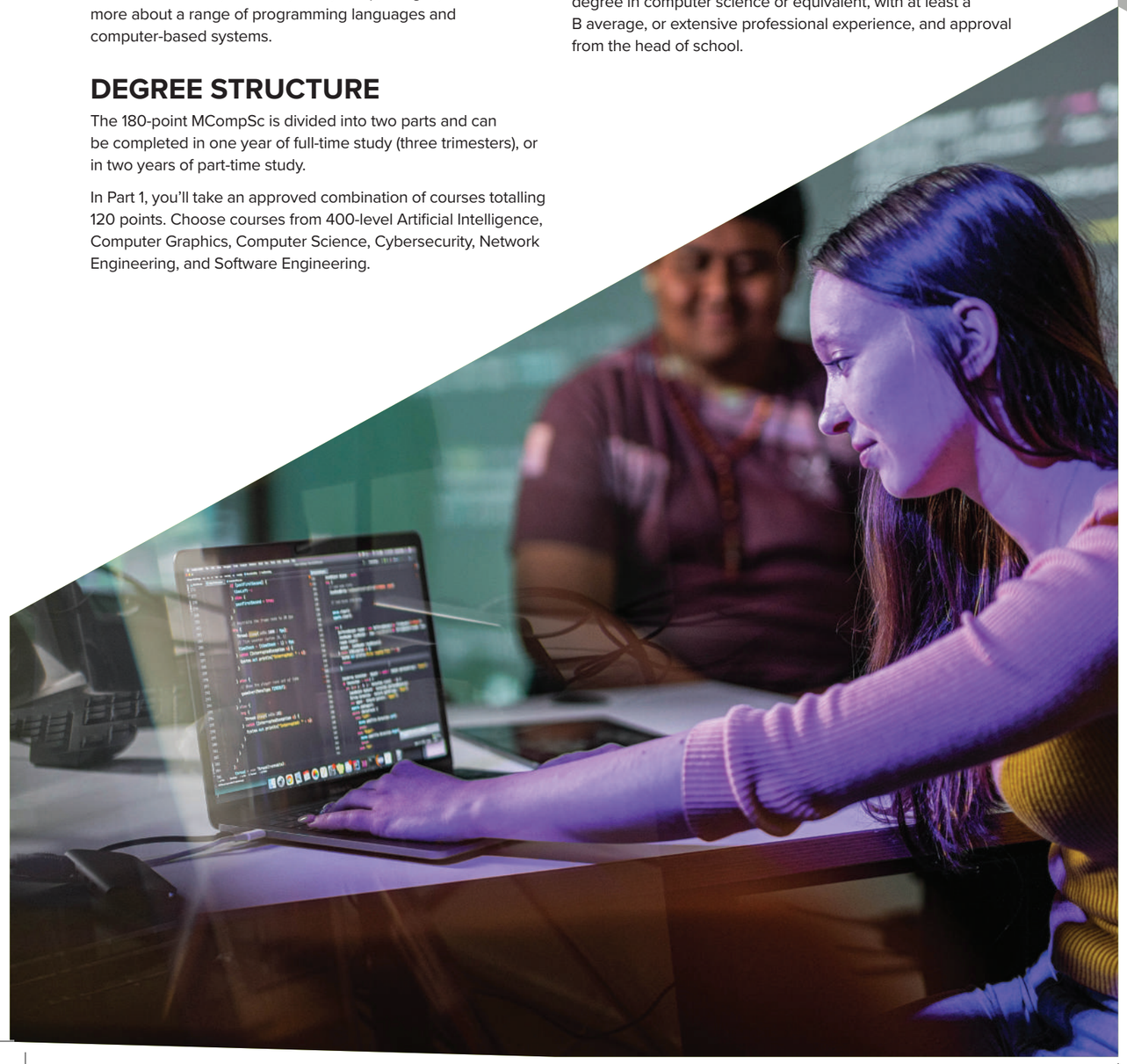
The 180-point MCompSc is divided into two parts and can be completed in one year of full-time study (three trimesters), or in two years of part-time study.

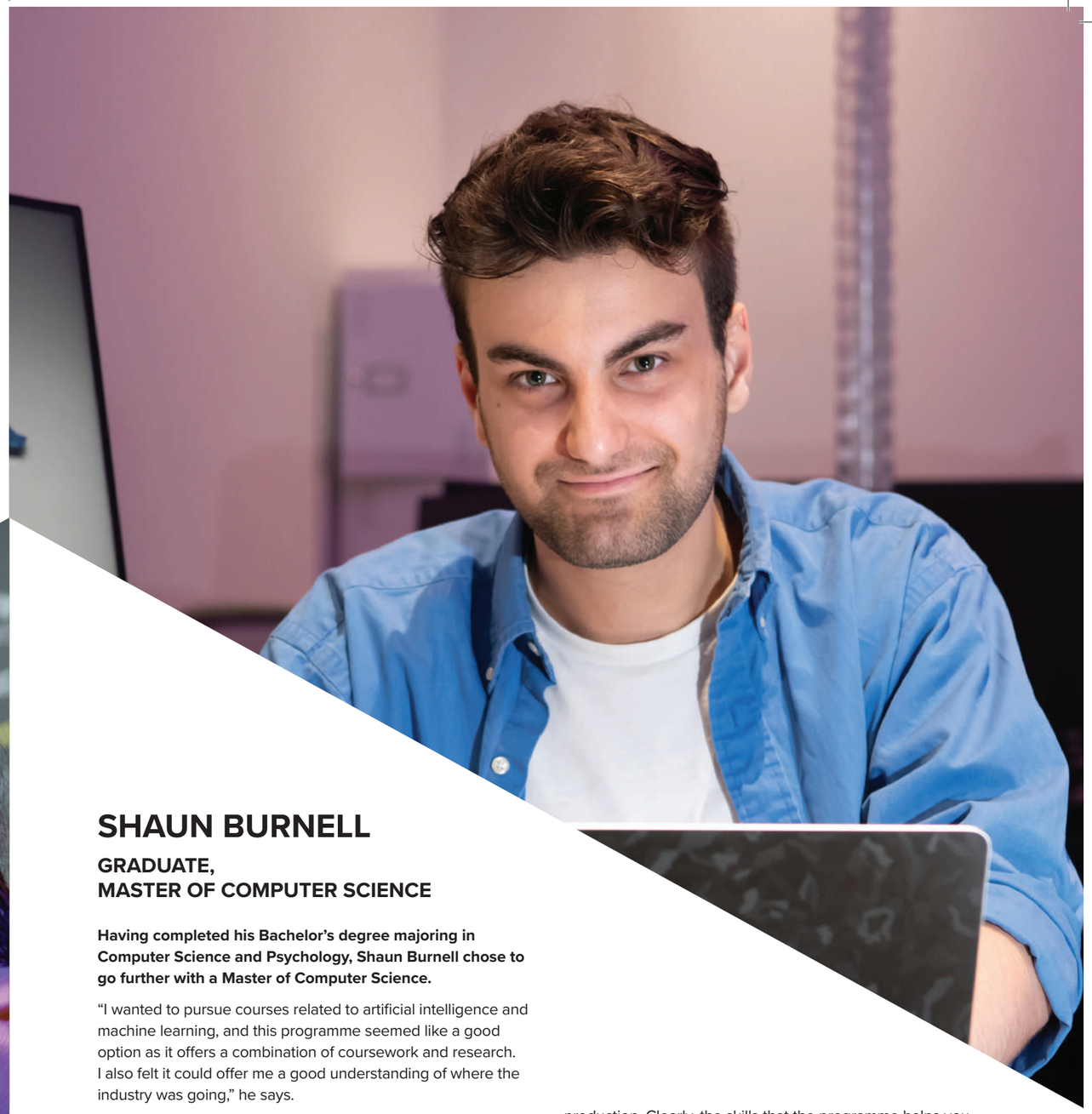
In Part 1, you'll take an approved combination of courses totalling 120 points. Choose courses from 400-level Artificial Intelligence, Computer Graphics, Computer Science, Cybersecurity, Network Engineering, and Software Engineering.

Part 2 is the research project, which is composed of two courses: COMP 501, a 15-point research essay that demonstrates you have understood the background to the research problem you have chosen to tackle, and COMP 589, a 45-point course in which you design, implement, and evaluate a solution to the problem.

ENTRY REQUIREMENTS

To be accepted into this programme, you will need a Bachelor's degree in computer science or equivalent, with at least a B average, or extensive professional experience, and approval from the head of school.





SHAUN BURNELL

GRADUATE, MASTER OF COMPUTER SCIENCE

Having completed his Bachelor's degree majoring in Computer Science and Psychology, Shaun Burnell chose to go further with a Master of Computer Science.

"I wanted to pursue courses related to artificial intelligence and machine learning, and this programme seemed like a good option as it offers a combination of coursework and research. I also felt it could offer me a good understanding of where the industry was going," he says.

His research focused on classification of streaming data, with a particular focus on text classification. "I really enjoyed learning about text processing and classification in one of my earlier courses and was keen on doing a project focused around it. Text processing has many practical applications these days—you see it in play every time you do a Google search or have autocomplete recommend a word. More specifically, I looked at how genetic programming can be used for classifying text on streaming data. It's a relatively new field, relevant in times like this when social media generates data at unprecedented rates."

The connections he made during his programme gave Shaun the opportunity to work with a local technology-based start-up. "I was able to use some of the skills I picked up last year to implement machine learning systems into their production. Clearly, the skills that the programme helps you learn are what the industry is looking for.

"I was also able to interact first-hand with cutting-edge research in this field, as the University has some of the top researchers in evolutionary computing. Being able to hear them speak and understand their perspectives greatly added to my own learning," he says.

"I found it very exciting that some topics I studied had been studied only in the past few years. Not only did I see the conversations about these topics develop, but the work I've done contributes to research in these areas. And that's a great feeling."

MASTER OF ENGINEERING

Go deeper into the world of engineering and conduct research in an area that interests you with the Master of Engineering (ME).

The research experience, technological know-how, and creative problem-solving skills you will gain from the ME will open up new opportunities for you in your career. You might find work in electronics, robot design, or renewable energy systems. Other career options include hardware development, programming, software engineering, and systems management. Alternatively, you may also further your research career by subsequently entering a PhD programme.

DEGREE STRUCTURE

The ME is a one-year full-time programme, although you can choose to study it part time.

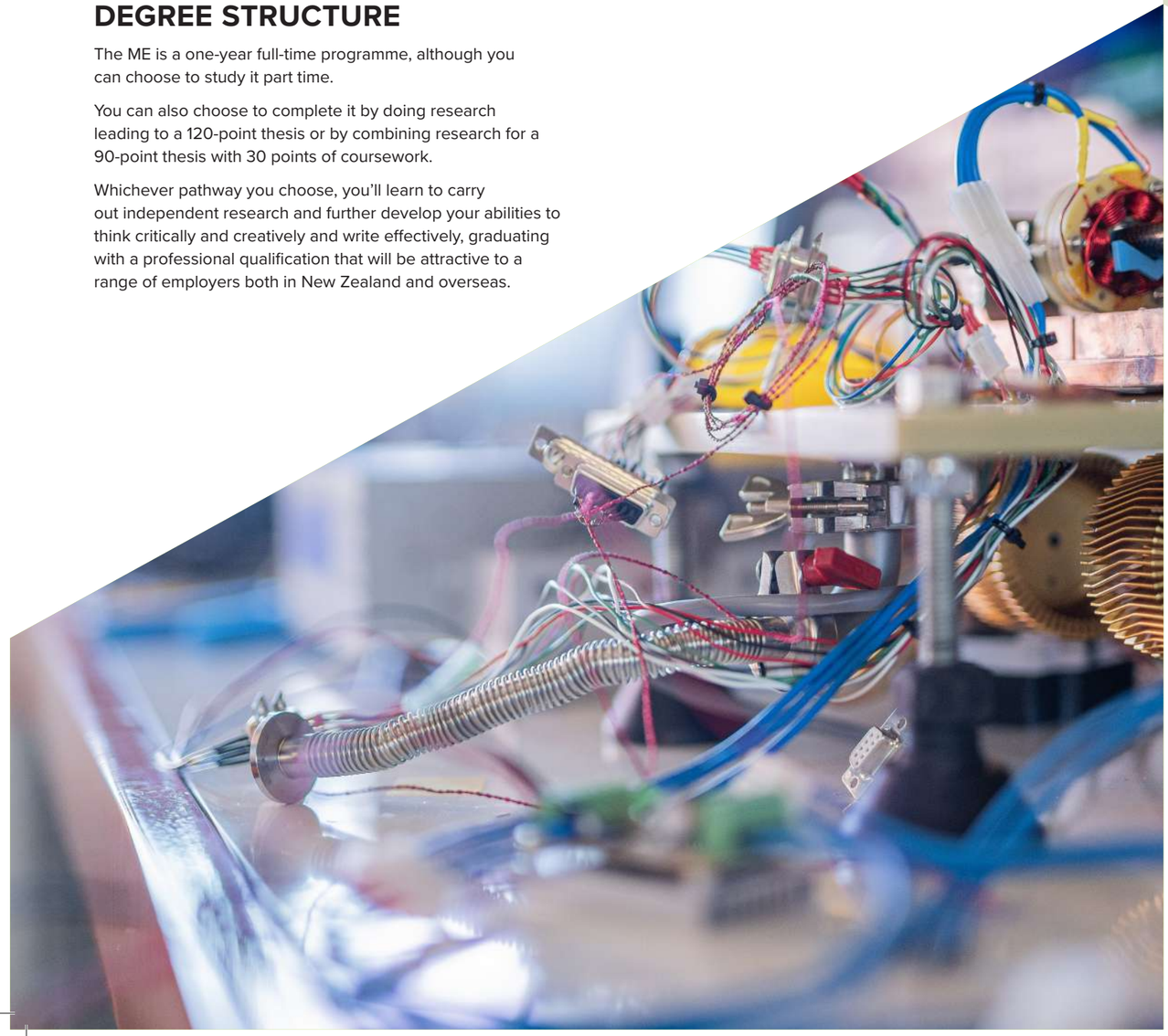
You can also choose to complete it by doing research leading to a 120-point thesis or by combining research for a 90-point thesis with 30 points of coursework.

Whichever pathway you choose, you'll learn to carry out independent research and further develop your abilities to think critically and creatively and write effectively, graduating with a professional qualification that will be attractive to a range of employers both in New Zealand and overseas.

You will be supervised by one of our expert researchers and will work on a research project agreed between you and your supervisor. Your final thesis will be examined by two experts, one of whom will be from outside the University.

ENTRY REQUIREMENTS

To be accepted into this programme, you will need a Bachelor's degree in a relevant field, with First or Second Class Honours, or extensive professional experience, and approval from the head of school.



DUNCAN CAMERON

PhD CANDIDATE
GRADUATE, MASTER OF ENGINEERING

How does a Master of Innovation and Commercialisation degree lead to a Master of Engineering degree?

"My thesis topic under the earlier programme was on wireless networks, and I started my research with a lecturer in the Wellington Faculty of Engineering. I really enjoyed the experience, and with my supervisor's encouragement, decided to enrol for the Master of Engineering, specialising in network engineering," explains Duncan Cameron.

Duncan's research focused on energy optimisation of wireless backhaul networks. He devised a lightweight traffic engineering tool called Segment Routing over MPLS, or SR-MPLS, for supporting those who operate wireless networks in areas with energy-harvesting constraints.

Duncan enjoyed the overall research process. "The Master of Engineering programme has been a fantastic opportunity to develop my passion for wireless networking. I'm interested in exploring how wireless optical networks and radio-over-fibre research can be used to improve energy efficiency on modern wireless networks. I'm now enrolled for a PhD."

Besides the academic components, Duncan believes other aspects of the Faculty have enhanced his overall learning experience. "There are opportunities for postgraduate students to socialise. There is life outside the programme, where you can meet new and exciting people and make friends for life.

"I also believe that some of the skills I developed as part of my programme were important in a project that I worked on with another student for Wellington UniVentures (the University's commercialisation arm) on automated network monitoring.

"Most of all, I really enjoy living in Wellington. The cultural richness that this city has to offer is simply not shared by many other New Zealand cities. For those wanting the best that New Zealand has to offer, I have no doubt that it is here in Wellington."

MASTER OF ENGINEERING PRACTICE

Employers need ICT professionals and engineers who have the skills to work effectively in the New Zealand workplace. These skills include good communication and teamwork and an understanding of the professional environment, alongside strong technical knowledge.

Gain skills in communication, problem-solving, and enterprise to complement your technical knowledge, and fast-track your career in this fast-growing industry with the one-year Master of Engineering Practice (MEP).

DEGREE STRUCTURE

The 180-point Master of Engineering Practice combines taught courses with a 12-week (one trimester) research project or paid industry placement to give you practical knowledge and experience.

You'll have the option to choose courses in your area of interest, including:

- Electronics: Electronics encompasses both the hardware and the embedded software that enable the multitude of smart devices and systems in our modern technology. Study this hardware–software interface to contribute to the next generation of sensor devices, communication systems, and signal-processing applications.
- Mechatronics: From mobile phones to autonomous robots, the modern world depends upon mechatronic systems. Some of the most exciting breakthroughs in technology are happening in the field of robotics and mechatronics, including automation and artificial intelligence.
- Networked applications: Our world is becoming increasingly digital. As more items become part of the internet of things, we need skilled engineers who can design, configure, test, and secure networks. Create distributed networks that connect the world through millions of everyday devices.
- Renewable energy: Alternative energy technologies are rapidly becoming affordable, and it is well accepted that these will be immensely disruptive to our traditional mode of centralised energy generation, transmission, and distribution. Be at the forefront of this emerging industry.
- Software engineering: Software is the technology driving innovation and change in the world's biggest industries, including healthcare, transport, and financial services. Give yourself an edge in this fast-growing field.

ENTRY REQUIREMENTS

To be accepted into this programme, you will need a Bachelor's degree or equivalent, with at least a B+ average, and approval from the head of school.

SHARAN PRASAD

GRADUATE, MASTER OF ENGINEERING PRACTICE

Sharan Prasad says the exciting combination of academic learning and practical experience within the Master of Engineering Practice is what motivated him to enrol.

Originally from Bangalore, India, Sharan says Wellington is a great place to study and live. "I love how warm and welcoming the people of this city are. I feel that there are very good opportunities here that would be great learning experiences for me.

"The University has provided me with some excellent opportunities to learn, like interacting with real-world clients as a part of our study, excellent technical courses, and solid infrastructure facilities. I also had the opportunity to tutor for an undergraduate course."

MASTER OF SCIENCE

Contribute to knowledge in your field with a degree that is recognised globally.

Studying for a Master of Science (MSc) degree, you'll gain valuable skills in technical and academic writing. You'll have the opportunity to undertake in-depth research in an area of your interest, alongside researchers from across the world, and publish articles in leading journals.

As well as contributing to specialist knowledge in an area of your choice, the Master of Science degree also opens pathways to doctoral degrees and further research.

DEGREE STRUCTURE

The 240-point Master of Science can be completed in two years of full-time study (or four years of part-time study) and forms the foundation for advanced study in a specific area.

In the first year, you'll take several courses related to your chosen area. In the second year, you'll undertake in-depth supervised research, culminating in a written thesis.

The combination of eight taught courses and a thesis gives you an opportunity to understand how theories covered in the programme apply to real-life scenarios. You can choose one of four majors:

- Artificial Intelligence
- Computer Graphics
- Computer Science
- Electronic and Computer Systems.

ENTRY REQUIREMENTS

To be accepted into this programme, you will need a Bachelor's degree in computer science or equivalent, with at least a B+ average, or extensive professional experience, and approval from the head of school.

BENJAMIN EVANS

GRADUATE, MASTER OF SCIENCE IN COMPUTER SCIENCE

It's interesting how chance encounters can lead you along paths you would have not opted for otherwise. And it was one such chance encounter with an introductory course on artificial intelligence (AI) that led Benjamin Evans to pursue a doctoral degree in AI.

"I had every intention of leaving after I completed my Bachelor of Science degree. But that course sparked my interest so much that I stayed on to finish an additional Honours year, followed by a Master's degree in computer science, focusing on AI," says Ben.

The opportunity to interact with and learn from staff engaged in world-renowned research proved positive for Ben. "Everyone is passionate about the field, and there's a large cohort of like-minded graduate students to support and encourage you. The content is mentally stimulating, and great help is always available at all levels throughout your studies. The skills you learn here put you highly in demand for employers domestically and globally.

"I've also picked up other skills that transfer to all areas of life, such as public speaking and teaching skills. And the connections I made throughout my studies have been invaluable.

"AI is one of the most interesting topics of our era, and in the grand scheme of things we are only at the very beginning stages of the field. I enjoy the constant progress of the field, and there are still so many open questions and problems that make the area fascinating to work in. That's the reason I chose to continue pursuing my academic career, though I've had various employment offers from the industry."

Living in Wellington played a huge role in Ben's journey as a student at Te Herenga Waka—Victoria University of Wellington. "Wellington is a tech hub, with tech giants and start-ups alike in the CBD. And the city has something to offer everyone while retaining a cool, laid-back feeling."

MASTER OF SOFTWARE DEVELOPMENT

Get the technical skills you need to work as a software developer.

The Master of Software Development (MSwDev) is designed to equip people from a range of technical and non-technical backgrounds with a strong, industry-focused qualification. Gain skills in programming and software development that will enable you to develop software-based solutions for a range of industries.

DEGREE STRUCTURE

The Master of Software Development is a full-time, 180-point programme. It is expected that you will complete the full MSwDev within 12 months, through three consecutive trimesters of study.

The programme is made up of four courses that are a combination of practical taught courses and a research and development project to give you practical knowledge and experience.

ENTRY REQUIREMENTS

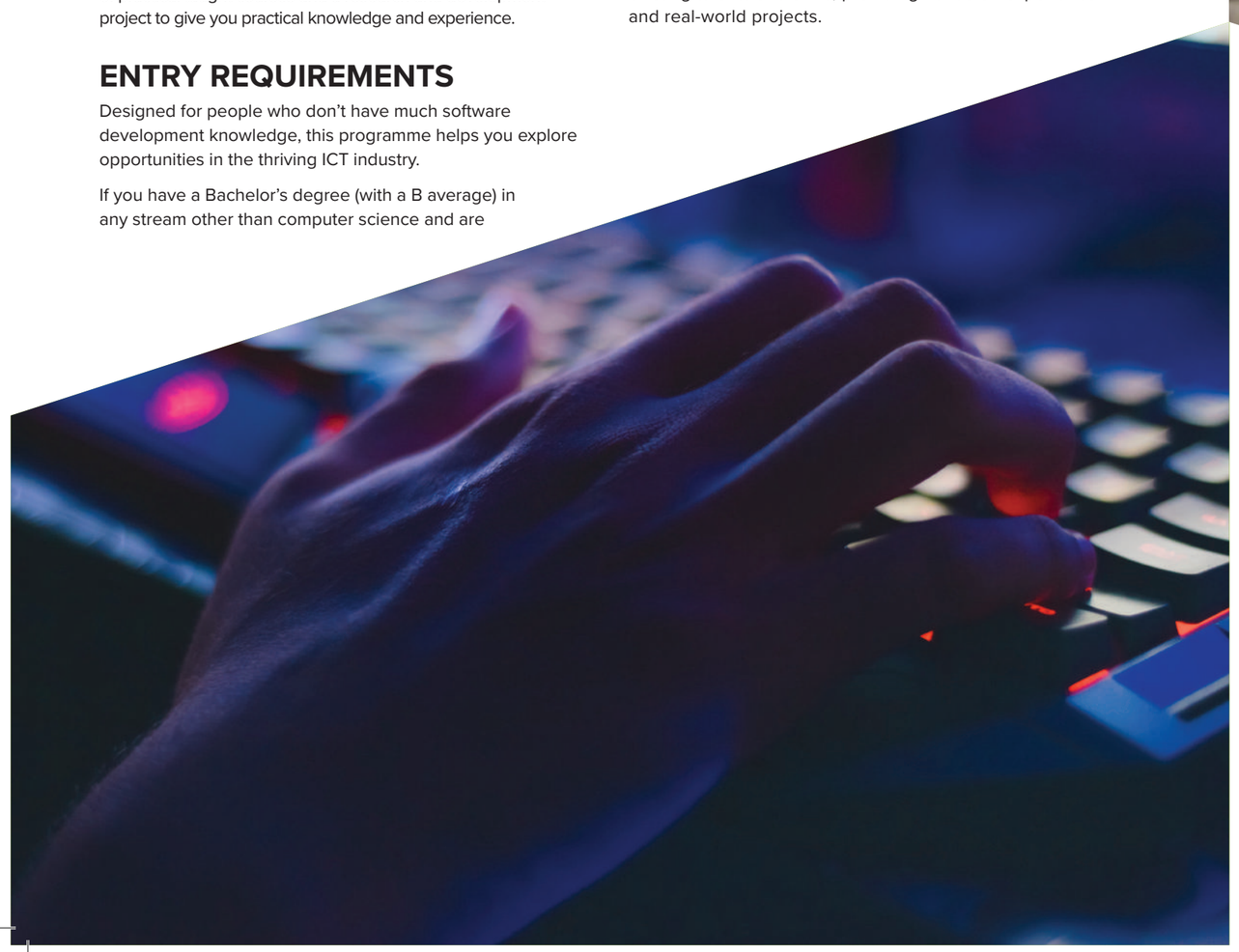
Designed for people who don't have much software development knowledge, this programme helps you explore opportunities in the thriving ICT industry.

If you have a Bachelor's degree (with a B average) in any stream other than computer science and are keen on exploring a career in IT, this is the path to your new career. Recent graduates, as well as experienced candidates who want to broaden their career opportunities, are welcome.

It is preferable, though not compulsory, for students to have a basic level of experience with programming.

WELLINGTON ICT GRADUATE SCHOOL

The Master of Software Development is offered through the Wellington ICT Graduate School (see page 12), which is an initiative led by Te Herenga Waka—Victoria University of Wellington to create direct pathways from education to employment. Its programmes were created with input from the industry and are designed to build upon people's existing talents and skills, providing hands-on experience and real-world projects.



KAITLIN MADDEVER

GRADUATE, MASTER OF SOFTWARE DEVELOPMENT

Kaitlin Maddever completed a degree in linguistics, but it was a career in building things that people used that she sought.

This led her to explore the Master of Software Development programme at the Wellington ICT Graduate School. "I'd enjoyed mathematics and science when I was at high school, and realised that I missed that sort of thinking. The Master of Software Development sounded like a great option because it is meant for people like me, with non-technical undergraduate degrees."

The in-person nature of the programme and its one-year duration were key reasons for Kaitlin to opt for this degree. "The person-to-person connection was especially important since I was a beginner looking to make a career for myself in this field."

The practical nature of the programme appealed to her. "I wasn't looking to add formal degrees that offered no practical experience, which is why I found the industry experience component of the programme very useful. My internship at Avenir Technology included creating an interface for clients to use—and this was great because it helped me look at what the client needed and customise the solution for them." She continued working on the project when she joined Avenir as a full-time developer after completing her internship.

"Software is an inherently collaborative field where you're working on tools that other people have made, and it's very likely that someone else, with their own skill sets, will work on it again at a later point. It's this sort of collaboration that I really enjoy, because there are always new things to learn and new tools to make your life easier—or harder!

"It's been an incredible journey since I got here—pursuing what I cared most about at the time, learning from it, and using that to determine what direction to go next. But it's really important to cultivate that sort of curiosity, to try out something that you find interesting and see where it takes you," she says.

DOCTOR OF PHILOSOPHY

The Doctor of Philosophy (PhD) programme is a course of independent study, under the guidance of a research supervisor, in which you undertake a major piece of original research that makes a significant contribution to the knowledge or understanding of a field of study.

Coursework is not an integral part of the PhD degree, but some students may be required or encouraged to undertake a limited amount of coursework.

ENTRY REQUIREMENTS

A PhD normally follows a Master's or Honours degree (with a grade average of at least a B+) or other relevant experience. The minimum time for completion of a PhD is three years of full-time study, and students are expected to complete within four years of full-time study. Most candidates are enrolled for full-time study, but part-time enrolment may be possible. In special circumstances, we allow distance enrolment with prior approval.

FINDING A SUPERVISOR

All PhD candidates work under the direct supervision of leading researchers, usually at the University but sometimes at external research institutes.

Research degrees require at least one academic supervisor. If you know someone you would like to work with, you should approach them directly to discuss possible research projects.

Please note that finding a supervisor before you apply is advisable but not always necessary, and the final allocation of supervisors is done by the admissions committee, according to research interests and available resourcing.

STUDY SUPPORT

The University runs a range of workshops on research skills, which all PhD students are encouraged to attend.

ASSESSMENT

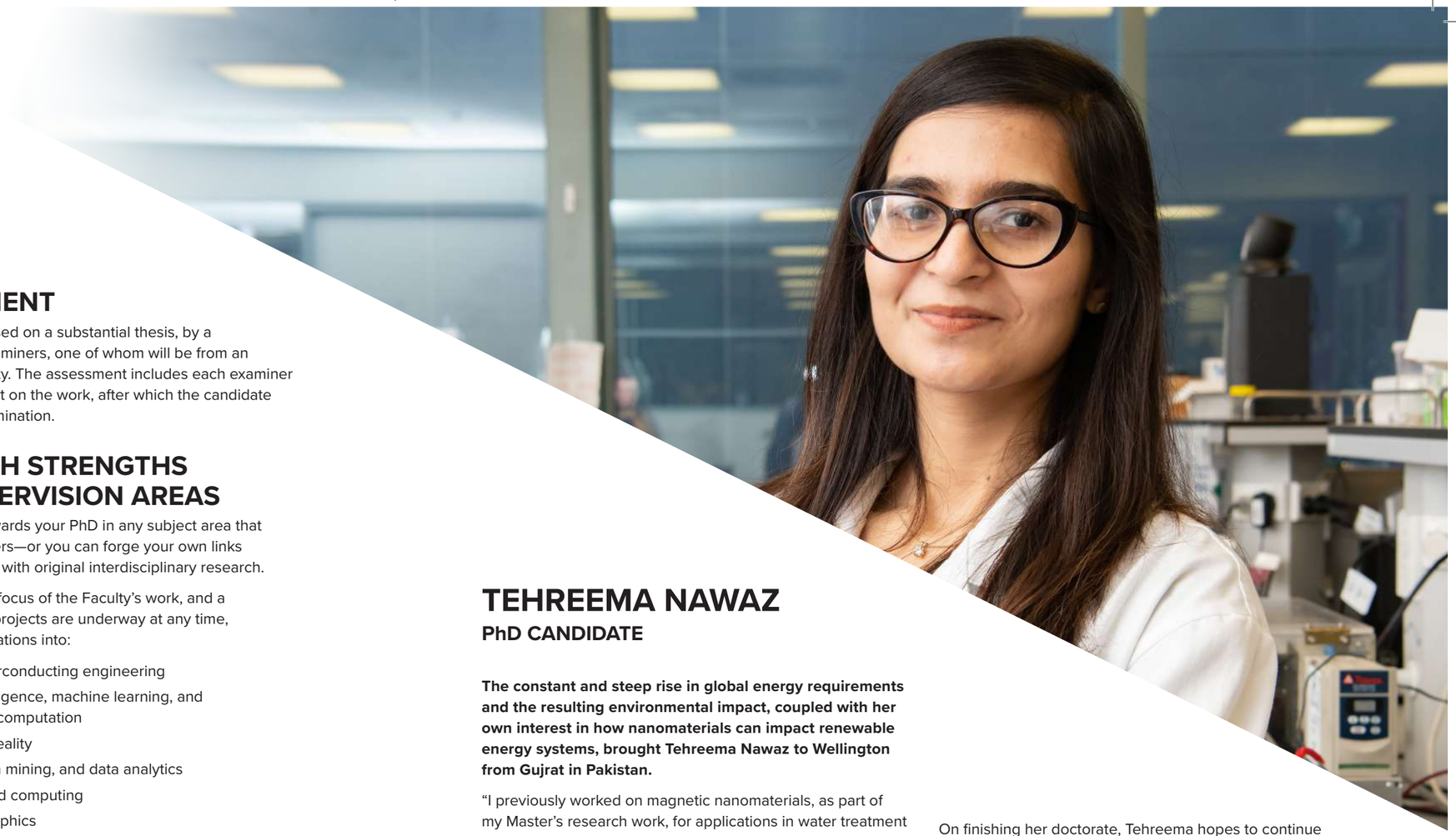
The PhD is assessed on a substantial thesis, by a panel of three examiners, one of whom will be from an overseas university. The assessment includes each examiner writing a full report on the work, after which the candidate faces an oral examination.

RESEARCH STRENGTHS AND SUPERVISION AREAS

You can study towards your PhD in any subject area that the University offers—or you can forge your own links between subjects with original interdisciplinary research.

Research is a big focus of the Faculty's work, and a diverse range of projects are underway at any time, including investigations into:

- applied superconducting engineering
- artificial intelligence, machine learning, and evolutionary computation
- augmented reality
- big data, data mining, and data analytics
- cloud and grid computing
- computer graphics
- computer vision, image processing, and visualisation
- cybersecurity, network security, and software security
- electronic materials and high-temperature superconductivity
- engineering and computer science education
- human–computer interaction
- magnetic resonance imaging (MRI) systems
- mechatronics and robotics
- programming languages
- renewable energy and smart power systems
- scheduling, combinatorial optimisation, and operations research
- sensor and sensor networks, instrumentation, and electronics
- signal and audio processing
- software-defined networks
- space technology
- superconducting machines
- virtual reality
- wireless communications and networking.



TEHREEMA NAWAZ

PhD CANDIDATE

The constant and steep rise in global energy requirements and the resulting environmental impact, coupled with her own interest in how nanomaterials can impact renewable energy systems, brought Tehreema Nawaz to Wellington from Gujrat in Pakistan.

"I previously worked on magnetic nanomaterials, as part of my Master's research work, for applications in water treatment systems. The nature of nanomaterials, their properties, and long-range applications had me completely fascinated. And that sparked the idea to explore whether we can apply them to questions related to sustainability."

Tehreema started her PhD in 2019, with a Ministry of Business, Innovation and Employment-funded project on inductive power transfer systems in electro-vehicles. "The main focus of my research deals with the novel fabrication of bimetallic nanofibres for wireless charging applications. The nanoengineering of such materials is important, as they show a high permeability in their commercially available reference materials. The idea is to use a bottom-up approach for nanosized materials with similar properties that can maximise power transfer in nano dimensions, due to their high surface area. This can lead to improved overall performance at relatively small budgets," she says.

"The effect of nano dimensions on the structural and magnetic properties is very interesting in these nanofibres. Different parameters, including the solvent, polymer, and metal ion fractions, can also affect the nucleation of nanofibres as well as the magnetic properties of these nanomaterials. For example, changing the fraction of metal ions of either nickel or iron can cause substantial change in the growth as well as in the magnetic properties of Ni1-xFex nanofibres. Moreover, thin diameters and uniaxial dimensions of nanofibres are advantageous for wireless charging applications."

On finishing her doctorate, Tehreema hopes to continue working in an area related to the synthesis of novel nanomaterials. "I believe that research along these lines can have potential implications for renewable energy and sustainability, and I'm very keen to explore what that could look like. In fact, we have some signs of what my research could lead to, and that's very exciting. There have been challenges along the way, mostly relating to the synthesis of some materials, but knowing what the study can lead to, my own natural curiosity, and the support from my supervisor have kept me going," she says.

"The world has advanced so much in wireless technology, be it in electric vehicles or electric toothbrushes. My degree has already brought with it some incredible, meaningful experiences. I've had the opportunity to collaborate with researchers at the Paihau—Robinson Research Institute, the School of Chemical and Physical Sciences, and GNS Science, and each interaction has brought a lot of learning with it."

Having been in New Zealand for two years, Tehreema has found life in Wellington very easy to adapt to. "Everyone is so friendly and welcoming. I really like the proactive, yet peaceful, work culture. And above all, the natural beauty of New Zealand is inexplicable!"

RESEARCH SPOTLIGHT:

NURTURING INDIGENOUS CONNECTIONS

A $250,000 grant from the Vision Mātauranga Capability Fund will help strengthen links between Te Herenga Waka—Victoria University of Wellington and Te Ruapekapeka Trust in Northland.

The grant has been awarded to Te Kura Mātai Pūkaha, Pūrorohiko—School of Engineering and Computer Science assistant lecturer Kevin Shedlock (Ngāpuhi, Ngāti Porou, Whakatōhea), who is working towards his PhD in Indigenous knowledge systems and the construction of virtual reality (VR).

The fund, administered by the Ministry of Business, Innovation and Employment, aims to strengthen skills and networks between Māori and the science and innovation areas, and lift understanding of how research can contribute to the aspirations of Māori organisations.

Kevin says the internet offers chances for improving global equality, but only if the knowledge is shared on how best to use it.

He has been working with Māori and North American Indigenous communities on VR and framing information technology artefacts—artificial versions of things in the real world. He has recently led several high-value projects for iwi communities, including Te Ruapekapeka Trust, working with iwi and hapū in the Northland region to tell tribal stories of Te Ruapekapeka Pā heritage site.

Kevin is thrilled to receive the grant and be able to use it to foster links between the trust and the University. “It reinforces to me there is a need for this work to occur with iwi. However, with this award comes a responsibility to maintain those relations, to act in the interests of those we serve as researchers.”

He sees the partnership with the trust as ongoing and one that could expand to include other iwi.

Kevin provided technical support to the iwi during the reconstruction of the trust’s website, which includes digital reconstructions of the pā at its peak in 1846.

“Ruapekapeka represented a transition from traditional Māori pā to defences specially designed to counter the long-distance projectile and explosive weaponry of the British. The site is remarkable to this day, with its highly visible and well-preserved defences carved into the landscape.”

Kevin hopes the virtual pā will reconnect whānau across the world and allow iwi members to tell hapū stories in schools. “Engaging with technology in a positive manner will raise awareness of the challenges for adopting strategies to deal with Māori data governance, data sovereignty, data ethics, and the use of data algorithms to retell stories where the data is protected.”

He also recognises VR offers “tremendous opportunities” for Māori communities to experience themselves in settings not available in the real world.

“However, the concern is VR as a technology may be replacing the traditional identity of users with an online digital version of themselves. Any deviance from heritage or known Indigenous relationships may result in a disconnection between the traditional world and the unreal digital world if wrongly presented.”

Kevin says it is vital Indigenous knowledge and identity is produced and disseminated sensitively and appropriately. The exponential nature of technology continues to outpace traditional practice such as marae protocols (kawa).

“Take Zoom, for example. I personally have no problem with Zoom, but marae have not had the opportunity to establish protocols for digitally viewing tūpāpaku [the deceased] at a tangihanga, or wanting to engage with others via a digital pōhiri. And I’m not sure if it is even possible to perform a wero challenge on Zoom.”

RESEARCH SPOTLIGHT:

TELEPORTATION NOW A VIRTUAL REALITY

With the flick of a single switch, you can travel instantly to a remote location for a meeting with colleagues in other parts of the world. Or flick the same switch and you can be rubbing shoulders with other fans at a BTS concert at Wembley Stadium.

This is the potential of augmented virtual teleportation (AVT), a new technology being developed by researchers at the Computational Media Innovation Centre (CMIC) that enables remote telepresence.

Remote virtual reality (VR) ‘travellers’ are teleported to where the augmented reality (AR) hosts are located to interact in a shared augmented environment. Travelling, in this case, is achieved by blending AR and VR technologies with the use of 360-degree video and live streaming to combine virtual objects with live video in real time.

Centre director Associate Professor Taehyun Rhee says, “We use high-fidelity computer graphics with AR technology to seamlessly blend virtual objects into the shared space. This makes it possible for individuals to communicate, collaborate, and exchange knowledge and ideas across any distance, as though they were in the same location.

“It will unlock the power of teleportation in a digital way, allowing distant people to come together to travel, work, learn, and play in a way that we have not yet experienced.”

With AVT successfully eliminating the barrier of distance, the technology becomes relevant to a range of industries, from classrooms to field trips and films to live events.

“We may feel that we can’t get the true taste of a culture unless we actually travel to that specific region, but with AVT, it’s possible for a person to sit in a living room in Seattle and virtually do one of the great walks in New Zealand,” he says. “You can be fully immersed in the space and communicate with people there.”

Dr Rhee and his team are passionate about enabling people to form connections and believe AVT offers a new method for digital connection between people around the world who may otherwise be unable to meet. The global adoption of 5G will expand the potential for AVT. It will enable the augmented environment to appear even more real and have the quality to match human perception and cognitive thresholds.

Because industry is the key rationale behind CMIC’s cutting-edge research, the centre hosts an incubation space where staff can prototype their ideas. By focusing on innovative, user-oriented academic research, CMIC aims to be a key part of the growth story of New Zealand’s interactive media ecosystem.

Faisal Zaman’s life changed in 2016 when he put on a cardboard VR headset for the first time.

“I was really excited about the scope of research in this field and wanted to explore different aspects of AR and VR technologies such as data visualisation, remote collaboration, and immersive analytics. You just have to look around to see how AR and VR have influenced the way we work, even during tough times like the pandemic,” says Faisal, who is a doctoral candidate studying multi-user extended-reality collaboration for high-fidelity telepresence.

“But there is an opportunity to make the technology even more relevant to real-world needs. The Centre showcased some truly path-breaking work in AR and VR at the SIGGRAPH Asia conference in 2018, and this is one of the key factors that influenced my decision to come here.

“This is a great environment for research and collaboration. My colleagues are very friendly, and we all have access to some of the latest VR gadgets and the space to experiment with new ideas,” he says.

RESEARCH SPOTLIGHT:
SQUASHING SOFTWARE BUGS

Associate Professor Jens Dietrich from the School of Engineering and Computer Science is fascinated by the idea of finding flaws in software before organisations and end-users encounter them.

“The world as we know it is constantly changing and evolving. And technology is, and will continue to be, a major part of it. There are various touchpoints in our everyday lives where we interact with software—from an alarm clock to self-driving cars and automated transport services—but rarely do we think about the various points that the technology could fail.”

Jens’s research on fuzzing for bugs and vulnerability detection in enterprise software focuses on the potential real-world impact of identifying flaws in software before it is released.

“With ubiquitous technology comes greater risk of software security. This is a huge concern across the world and we often hear about how critical IT infrastructure is breached. There is a constantly increasing need for new and innovative ways to secure software,” he says.

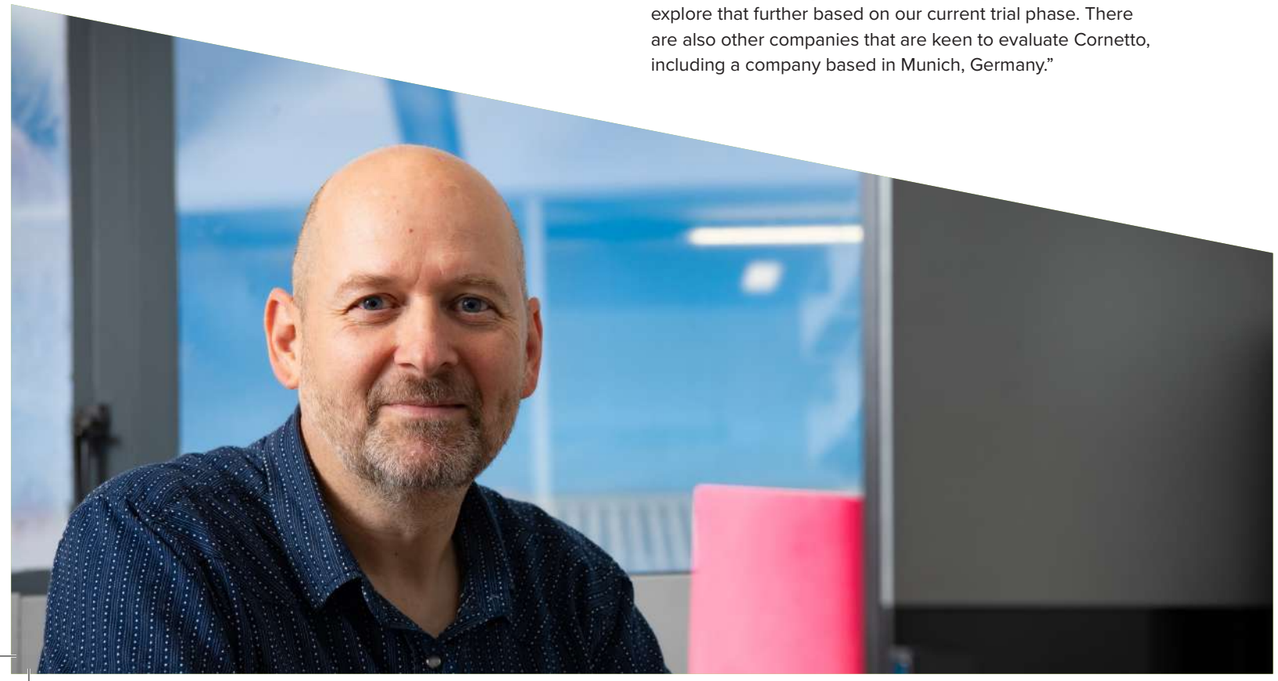
“We have developed a novel tool, dubbed Cornetto, which uses modern AI and programming techniques to create input for enterprise web applications. The tool mimics a browser and tries to automatically generate web requests that expose bugs and security flaws in applications. Random input generation to find weaknesses in software has been around for some time, but the reality is that this isn’t very effective, which is why we constantly need to innovate in this space.”

Having been involved in the discovery of several previously unknown vulnerabilities, Jens has a particular interest in grey-box fuzzing. “Grey box means that the process is smart, and that is it guided by on-the-fly analysis of the program it is testing and genetic programming techniques. My interest in grey box was sparked by a tool called American Fuzzy Lop (AFL), one of the first grey-box fuzzers that was incredibly successful in finding new vulnerabilities in smaller programs. Tools like AFL and Cornetto make a significant difference by adding intelligence to the process of securing software systems.”

Jens says the research experience was driven by the construction of the fuzzer software. “The system is very complex and has required numerous iterations to get it working on large and complex real-world programs. It took us nearly an entire year. And there were challenges along the way, a particular one being that the system we developed is inherently non-deterministic. Each time we ran it, it behaved in a different way, and this meant we had to come up with ways to deal with this. On the other hand, this was also a stimulating mental challenge that kept us going.”

As well as his former PhD student and research assistant Shawn Rasheed, Jens also had the opportunity to collaborate closely with Francois Gauthier and Behnaz Hassanshahi, researchers from Oracle Labs in Brisbane.

“We’ve started working with a local company that specialises in software testing to evaluate how Cornetto can be used in software security audits. This is our road-testing. I believe that this research has significant commercial potential, but we will explore that further based on our current trial phase. There are also other companies that are keen to evaluate Cornetto, including a company based in Munich, Germany.”



RESEARCH SPOTLIGHT:
SUPERCONDUCTORS FOR SPACE PROPULSION

Bringing together innovative engineering and applied physics to build advanced technologies for businesses worldwide, the Paihau—Robinson Research Institute is recognised worldwide as a pioneer and leader in high-temperature superconductor (HTS) research.

Jakub Glowacki began his journey as an engineer with the Institute in 2018, with his research focusing on high magnetic field thrusters for space. “With its vast distances and essentially endless opportunities, space has always fascinated me. We are still in the nascent stage of space exploration, where even a safe transfer to the Earth’s orbit is a challenge. Being part of the Institute’s space programme is a great opportunity to make a fundamental impact on human knowledge and to contribute to this inspiring effort,” he says.

The Institute was awarded $11.6 million in the Ministry of Business, Innovation and Employment’s 2020 Endeavour Fund round for its space research programme developing electric propulsion incorporating superconducting magnets on spacecraft.

“Building on our expertise in superconducting technology, we are working on a magnetoplasmadynamic thruster that would use strong magnetic fields to accelerate future space missions. Efficiently moving objects in space is a challenge due to the vast distances. Chemical propulsion, the traditionally used method, requires large amounts of fuel. Electric propulsion enables us to reduce this mass burden and more efficiently thrust future spacecraft for missions to high Earth orbits, the Moon, and beyond. Superconductors, due to their near-zero resistivity in very low temperatures—minus 200 degrees Celsius—are characterised by high energy density which could enhance the capabilities of electric thrusters and enable faster mission deliveries, keeping magnet construction light and compact,” Jakub says.

“The project itself is a world-class challenge—so far no one has ever proven that a superconducting coil can operate in a space environment. A common misconception about space is that the cryogenic temperatures needed to reach a superconducting state are easily achievable because of the low temperatures in space. In reality, the opposite is true—operational space equipment often fails due to overheating. Add to that the fact that the energy required for satellites to operate is generated in scarce quantities and is subjected to periodic changes, which impacts the performance of our cooling systems. But we are working to prove that all these problems can be overcome, and we believe that the first mission we are building will spark an interest in superconductivity in space. We expect to see many more operational satellites by 2025, and they will require propulsion to position themselves, manoeuvre to avoid potential collisions, and for after-life decommissioning.”

The programme involves significant collaboration with other organisations. “We are working closely with our partners from the University of Auckland and the University of Canterbury, and have established strong ties with partners from Australia, Europe, and Japan. The project has strong commercial applications and we are already working with start-ups and large companies,” Jakub says.

The Robinson Research Institute has opened up various opportunities for Jakub. “The Institute has world-renowned expertise in fundamental science, with a growing branch in applied-field projects. Working here is an opportunity to work in the niche area between the industry and academia. For our students, it is a perfect opportunity to learn through finding solutions to real engineering problems.

“Being located in the Wellington region is another advantage—the city itself has a vibrant community and is a melting pot of Pacific, European, and Asian cultures. One thing I particularly like about Wellington is that it offers you the possibility to participate in ambitious research projects and to be a part of a world-class research community.”

SCHOLARSHIPS

Our strong research culture is reflected in our scholarships, which are available for PhD and Master's by thesis candidates in all disciplines. Graduate awards are open to graduates of any university enrolling in Honours or coursework Master's programmes. Scholarships are available for both domestic and international students. In addition to the Te Herenga Waka—Victoria University of Wellington scholarships outlined here, there may be specific project funding available through the Wellington Faculty of Engineering. Contact the Faculty office or talk to your prospective supervisor to find out about these.

PhD FUNDING

The University awards scholarships to applicants applying to the PhD programme on the basis of academic merit, research ability, and, if relevant, a publication record. Approximately 120 new PhD scholarships are offered each year, in three rounds. Wellington Doctoral Scholarships currently provide an annual stipend of $23,500 plus tuition fees for up to three years. Closing dates for PhD admission and scholarships are 1 March, 1 July, and 1 November each year.

OTHER POSTGRADUATE SCHOLARSHIPS

Wellington Master's by Thesis Scholarships are awarded to candidates on the basis of academic merit and the suitability of the research topic. They provide a stipend of $15,000 and domestic tuition fees for one year. Applicants must be undertaking a thesis of at least 90 points. The closing date is 1 November each year. Wellington Graduate Awards are open to students who will be enrolled full time in an Honours or Master's degree taken via coursework or a combination of coursework and a thesis or research project of fewer than 90 points. The closing date is 1 November each year.

- www.wgtn.ac.nz/phd-apply

INTERNATIONAL STUDENTS

Te Herenga Waka—Victoria University of Wellington is New Zealand's most internationalised university, with students from 114 countries, more than 140 university partners worldwide, joint teaching in a number of countries, a campus in Viet Nam, and about 50 percent of staff from overseas. Our research and teaching are strengthened by our diversity.

The first point of contact for information and advice for international students is Wellington University International. Staff handle admissions and enrolment and provide award-winning student support so students get the very best out of their time here. We welcome all international students on arrival and organise an orientation programme to help students establish themselves at the University and in the city.

We understand that living and studying in a foreign country may have highs and lows, and Wellington University International's student advisers are here to listen to and support you. Academic advisers are available in the faculties, but prospective PhD candidates should contact the Wellington Faculty of Graduate Research in the first instance.

- www.wgtn.ac.nz/international
- www.wgtn.ac.nz/fgr

WHO TO CONTACT

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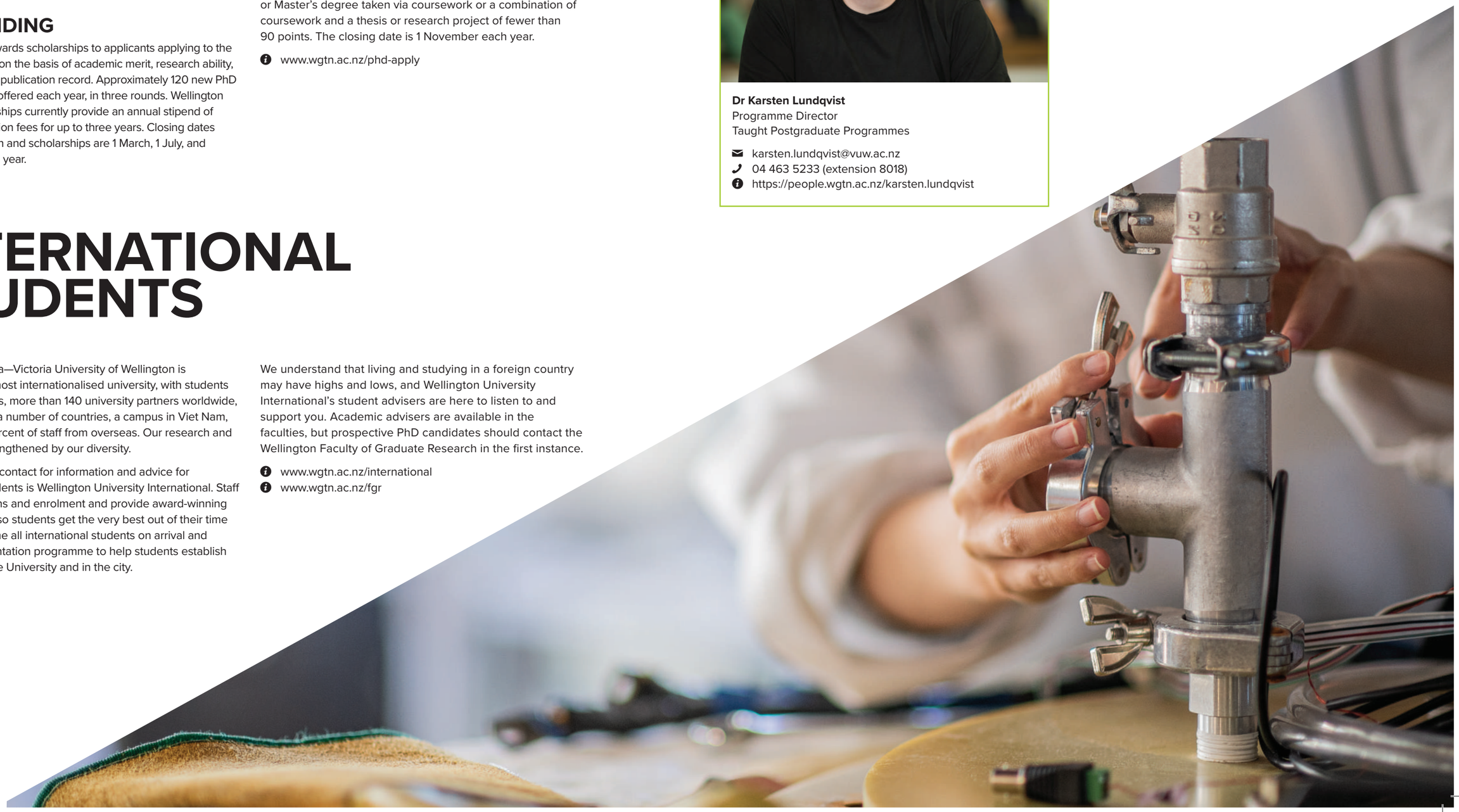

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