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Technology Centre:	Irish Manufacturing Research (IMR)
Academic Mentor	Dr. Philip Long
Company Partner:	KUKA Robotics Ireland
Company Mentor:	Brian Cooney

Keerthi received his PhD (2018) in Mechanics, measurements and Robotics Engineering from University of Genova, Italy. He obtained his Master's degree in Mechanical Design (M.Des) from Indian Institute of Information Technology, Design and Manufacturing, Kancheepuram (IIITD&M) and bachelor's degree (B.E) from Anna University. After his doctor studies, Keerthi continued to work in University of Genova in the PMAR Robotics lab as a post-doctoral research assistant on EU-H2020 project involving Human-Robot Collaboration and other industry-oriented projects.

Dr. Philip Long

Dr. Philip Long is a Senior Researcher in the Robotics & Automation group at IMR. His research interests include kinematic and dynamic modelling of serial and parallel robots, sensor-based control, and human robot collaboration. He has extensive experience in technology transfer projects in robotics, having worked in both industry and academia for over 12 years. He obtained his PhD in Robotics from Ecole Centrale de Nantes, France focusing on cooperative robotic control for applications in meat processing industry. At IMR, he is Principal Investigator on several large-scale technology transfer projects in robotics totalling over €1.5 million including the Smart Eureka MAAS project and the DTIF awarded Ferrtest. During his time as a Postdoctoral researcher at Northeastern University, Boston, he has contributed to high TRL university led projects, notably the U.S Department of Energy led project which used NASA's humanoid robot Valkyrie for nuclear decommissioning and seafood handling project financed by U.S Department of Defence. Previously, at IRT Jules Verne, Nantes, France, he was the technical lead for the collaborative robot team with the objective of developing sensor-based control schemes for industrial partners: Renault, Airbus, Faurecia and Alstom (GE). He has publications in several top tier robotics journals and conferences and 4 international patents. He is an associate editor for IEEE's flagship robotics and automation conference ICRA- (International Conference for Robotics and Automation). He has experience mentoring Erasmus Mundus Masters Students, and fellows from the Gordon Engineering Leadership Program as well as serving on two PhD committees. He lectured Robot Dynamics & Control at Northeastern University.

Mr. Brian Cooney

Mr. Brian Cooney is the Managing Director of KUKA Robotics, Ireland, subsidiary of the renowned German Engineering Group KUKA AG. A mechanical engineer by background, he has worked in Industrial Automation for more than 30 years and has held senior engineering, sales and management positions in high profile manufacturing companies including ABB and CPI Technology. With more than 20 years of experience in robotics, he has been at the forefront of the technology in Irish manufacturing and is a regular speaker and participant on many industry and Manufacturing forums, national sub-committees as well as advisor to many companies on an individual basis. He has led KUKA from initial smaller presence to one of the largest suppliers of automation products in Ireland.

IMR - Irish Manufacturing Research Ltd.

Irish Manufacturing Research Ltd. (IMR) is an agile, independent research technology organisation at the heart of a regional ecosystem of partners, including more than 150 companies. IMR support Irish SMEs and Mid-Caps to demystify, de-risk and deliver emerging technologies for manufacturing under the core thematic areas of digitisation; automation and advanced control; design for manufacturing; and sustainable manufacturing. IMR are experienced in working with industry on their specific challenges and overcoming barriers to engaging in research and development. IMR is Ireland's only Regional Manufacturing Digital Innovation Hub, providing a one-stop-shop for industry to access the supports they need to join the next generation of smart manufacturing. IMR cooperate closely with other innovation actions transferring innovative solutions into the wider manufacturing community and delivering results, with industry. IMR's Robotics & Automation team focuses on enabling manufacturing companies to exploit recent advances in robotics in the areas of human robot collaboration, adaptive assembly and agile manufacturing. The team is involved in several European projects and numerous domestic technology transfer projects bringing an economic benefit to partners in 2019 of over €4.4 million. The robotics and automation team focuses on adapting lower TRL approaches to complex manufacturing challenges in order to present a pre-commercialization prototype to the end users including data, code and reports to facilitate interactions with third party integrators.

KUKA Robotics Ireland

KUKA (Keller und Knappich Augsburg) is a world technology leader in robot manufacturing. Established in 1898, KUKA were revolutionary in bringing the first generation of industrial robots in 1971 and have constantly adapted to emerging technologies and ideologies of Industry 4.0. The latest generation products include mobile robots, manipulator arms, cobots, robots with virtually all payload ranges, IoT tools, are part of the KUKA's arsenal which deliver holistic cutting-edge futuristic solutions. KUKA research and development is deeply rooted in innovation ideologies in which they host annual flagship Innovation awards to explore challenging research problems that can be solved with robotics and are directly involved with several European funded projects. Kuka Robotics Ireland Limited was set up in April 2016 in Dundalk, to cater to the demand of significant growth in Ireland and to cement the position of only OEM-robot supplier in the nation. A state-of-the-art facility was established to complete significant installations in Ireland. The 281m² offices provide client support to all its Irish customers, including sales, customer services and training. KUKA's facility in Dundalk is equipped with multiple 6-axis industrial robots, collaborative systems and mobile robots. These systems are typically used for training and demonstration and will be available for testing for the duration of the project.

KUKA is a strong supporter of research and manufacturing associations across the globe and, as such, KUKA Ireland has been working in close collaboration with IMR and are a member of REDF funded NREC project. KUKA Ireland are actively associated with diverse industries from different backgrounds in Ireland. This provides KUKA with a deep understanding of the current technological bottlenecks that prevail among industries.

Keerthi's project

No greater emphasis can be made on the role of medical devices than the current Covid-19 situation. Medical device manufacturers face growing pressure to accelerate manufacturing speed, reduce production costs and delays in launch of new products to market while simultaneously maintaining strict quality guidelines. This has accelerated the need for adaptation of complex industrial automation.

To address the complex industrial automation requirements, **Project FineTETHER**, will develop a robotic work cell with two manipulator arms, a perfect emulation of human features deployed with a full suite of state-of-the-art haptic, visual and force sensor modalities. The objective is to precisely manipulate the remote medical environment and to fully perceive the environment as if directly encountered by human operator. Novel kinematic, planning and control strategies will be explored to achieve fine manoeuvring of complex parts. The project will also explore shared autonomy where a robot can execute the simpler parts of the task semi-autonomously and require operator instruction only during complex manoeuvres. The efficiency of the integrated work cell will be assessed by measuring the accuracy and repeatability of the test assemblies, and in addition the comfort level of the human operator during this immersive

feedback. The application use-case scenario is relevant for Ireland which hosts 18 of the top 25 global medical device companies. With such a significant number of medical manufacturers, both KUKA and IMR acknowledge Ireland's strategic advantage and are keen to cater to this specialized market.