Exponent®
Engineering & Scientific Consulting

James Frake, Ph.D., MInstP

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Professional Profile

Dr. Frake is an experienced product research and development physicist. He has commercial expertise in solving multidisciplinary product and technology R&D challenges throughout the development lifecycle. Dr. Frake's experience includes developing novel sensors and detection systems, designing and building measurement and metrology devices, engineering temperature control and cryogenic systems, wireless power, and the application and measurement of electromagnetic fields. In addition to product development, Dr. Frake also assists clients in troubleshooting product design issues, product failure or risk product capability enhancement, and industrial processing / manufacturing issues.

Dr. Frake has helped his clients throughout the product and technology development lifecycle, including early stage innovation and concept generation, concept assessment, market research, technology landscaping, proof of principle testing, mathematical modelling, data analysis, and prototype development. He has worked across many markets, including medical devices, pharmaceutical, oil & gas, mining, consumer devices, industrial and the food & drink industry.

Dr. Frake's PhD was in the electrical measurement of quantum semiconductor devices at high frequencies, for applications in quantum computation, novel electronic density of states measurements, charge pumping, and primary thermometry. During his PhD, he developed skills in semiconductor fabrication, semiconductor device analysis and testing, optical and e-beam lithography, SEM and AFM techniques, precision electrical measurements and RF electronics. To engage with his research, Dr. Frake also became experienced with cryogenic systems including Helium 3 and dilution refrigerators, superconducting magnets, and high vacuum systems. Before joining Exponent, Dr. Frake worked as a consultant at Sagentia Ltd., a science, technology and product development consultancy in Cambridge, UK.

Academic Credentials & Professional Honors

Ph.D., Physics, University of Cambridge, England, 2014

MPhys, Physics, University of Leeds, UK, *Honours, 1st Class*, 2008

Bragg Scholar

Prior Experience

Consultant – Sagentia Ltd, 2013-2019

Professional Affiliations

Member of the Institute of Physics (MInstP)

Publications

Nature Scientific Reports 5, Article number: 10858 (2015) – “Radio-frequency capacitance spectroscopy of metallic nanoparticles”, J. Frake et al.

Applied Physics Letters 100, 143104 (2012) – “Quantized Charge Pumping Through a Carbon Nanotube Double Quantum Dot”, S. J. Chorley, J. Frake, C. G. Smith, G. A. C. Jones, and M. R. Buitelaar.

Physical Review Letters 108, 036802 (2012) – “Measuring the Complex Admittance of a Carbon Nanotube Double Quantum Dot”, S. J. Chorley, J. Wabnig, Z. V. Penfold-Fitch, K. D. Petersson, J. Frake, C. G. Smith, and M. R. Buitelaar

Project Experience

Examples of work areas Dr Frake has been involved in are:

Compliance support for medical device regulations in Europe, specifically the new MDR regulatory framework. This ranges from high level strategy and regulatory planning to detailed engineering assessment and inspections of devices to check for compliance.

Assessment and investigations into product risk and regulatory compliance testing.

Battery failure analysis and assessment for consumer and industrial products to assess root causes for failure.

Data analysis and processing using data science techniques and mathematical modelling to give clients actionable information from convoluted data.

Product research, development and innovation – including:

- Building customized sensors and measurement equipment in many industries, including medical devices, consumer devices, food and beverage, and industrial processing.
- Developing measurement systems and algorithms for condition and usage monitoring in many applications such as medical drug delivery systems, patient compliance monitoring, air conditioning systems, industrial pumping equipment and power tools
- Research and development of dermal biosensors and bio-impedance devices for medical and consumer applications.
- Research and development of electro-spraying, electro-spinning, and novel fluid atomisation technologies for consumer devices, medical devices and industrial manufacturing processes.
- High voltage and cold-plasma technologies for consumer products and manufacturing processes.
- Modeling and testing electric power cables using transmission line physics for remote fault detection systems.
- Research and development of wireless power systems for application in medical, industrial and consumer sectors.
- Technology scouting and evaluation exercises in many fields, including medical devices, position sensors, and downhole sensing technologies for the oil and gas industry.
- Freedom to operate and patent landscaping studies, technology assessments and due diligence of startup companies for venture capital investments.
- Development of novel air and liquid cooling systems, along with gas dissolution technologies and systems.