

Characterisation and classification of metallic threat objects for security screening

Abstract : The location and identification of hidden conducting threat objects using metal detection is an important yet difficult task. Applications include security screening at transport hubs and finding landmines and unexploded ordnance in areas of former conflict. Based on an asymptotic expansion of the perturbed magnetic field, we have derived an economical object description called a magnetic polarizability tensor (MPT), which is a function of the object's size, shape, material properties and the exciting frequency. We employ a finite element method, accelerated by a reduced order model and scaling results, to efficiently compute a large dictionary of invariants of MPT spectral signature characterisations of realistic threat and non-threat objects relevant for security screening. The talk will also discuss the performance of probabilistic and non-probabilistic machine learning classifiers for identifying hidden threat objects learnt from our dictionary.

Prof Paul Ledger: he is a Professor of Computational Mathematics at the School of Computing & Mathematics, Keele University, UK. Prof Ledger's research interests range from applied mathematics through computer science and engineering. He is particularly interested in the computational solution of inverse problems (imaging), computational simulation of partial differential equations (especially Maxwell problems) and reduced order models. More recently he has also become interested in machine learning, artificial intelligence and data science, especially in the context of probabilistic approaches to the solution of inverse problems. Prof Ledger finished his PhD in Zienkiewicz Centre for Computational Engineering in 2002 and started his career as a Lecturer in 2006, promoted to Associate Professor in 2013. He joined at Keele University in 2020 as a Lecturer and was promoted to a full Professor in January 2022. He holds an Honorary Associate Professor in the College of Engineering at Swansea University.

Room: Engineering Central B003 (Bay / Dpt)

Date(s): Thursday, 16/06/2022

Time: 13:30-15:00