PhD Advert Template

Your advert (including section headings) should **not** exceed **550** words.

Project title:

Design and Development of a Focusing Radar Antenna for Transport Infrastructure Subsurface Investigation

Project ID *(optional)*:

Accept all year-round applications

Funding information: Self-funded students only

Project description:

This project will develop and apply a novel focusing radar antenna to our pioneering rotational ground penetrating radar system which has been used to collect datasets of historic railway tunnel subsurface topography and is currently being used to investigate inland waterway locks.

An improved antenna is required to improve the depth of penetration of the radio waves and to limit the beam width. The antenna will operate within 5cm of the infrastructure external wall and will investigate the subsurface.

The main aims are to (i) distinguish structural features of interest from non-features; (ii) classify features as specific asset or defect types (e.g. void, crack, water ingress, etc.); (iii) characterize defects and return information of benefit to surveyors (e.g. dimensions, depths, material type, complexity etc.); (iv) automatically rank the severity of defects to convey to repair teams. Presently, we anticipate the research will produce a design for an antenna that will improve the existing point-cloud analysis architecture to accurately and reliably distinguish assets and such as ventilation shafts, refuges and catenary from defects including small-large voids, concealed shafts and water ingress, alongside background non-features including soil and healthy brickwork. Anticipated project outcomes would be design and prototype production of a novel antenna(s) capable of transmitting and receiving radio waves in different media such as concrete, masonry and soil.

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References:

1. Xiaoting Xiao, Guiyun Tian, Dong Liu, Mark Robinson and Anthony Gallagher “Developments in GPR Based NDT for Ballastless Track of High-Speed Railways” p227- 285, 2020 In Electromagnetic Non-Destructive Evaluation XXIII, Editors Tian GY and Gao B Publication Date October 2020. ISBN print 978-1-64368-118-4 ISBN online 978-1-64368-119-1

<https://books.google.co.uk/books?hl=en&lr=&id=by4NEAAAQBAJ&oi=fnd&pg=PA277&ots=Cf0Z> [ULcq7P&sig=n2HNCOJ4Cw5gOj6MVJoBxAVaYYc&redir\_esc=y#v=onepage&q&f=false](https://books.google.co.uk/books?hl=en&lr&id=by4NEAAAQBAJ&oi=fnd&pg=PA277&ots=Cf0ZULcq7P&sig=n2HNCOJ4Cw5gOj6MVJoBxAVaYYc&redir_esc=y%23v%3Donepage&q&f=false)

1. Mc Donald T, Robinson M, Tian G. Developments in 3D Visualisation of the Rail Tunnel Subsurface for Inspection and Monitoring. Appl. Sci. 2022, 12,11310.

<https://doi.org/10.3390/app122211310>

1. Thomas McDonald, Mark Robinson and GuiYun Tian, Spatial resolution enhancement of rotational-radar subsurface datasets using combined processing method. ICMSQUARE 2021 IOP Publishing Journal of Physics: Conference Series **2090** (2021) 012001 doi:10.1088/1742-6596/2090/1/012001
2. Liang Ge Changpeng Zhang; Guiyun Tian; Xiaoting Xiao; Guohui Wei; Ze Hu; Junaid Ahmed; Ju Xiang; Mark Robinson. “Current Trends and Perspectives of detection and location for buried non-metallic pipelines” Chinese Journal of Mechanical Engineering - Volume 34, Article number: 97 (2021) <http://dx.doi.org/10.1186/s10033-021-00613-z>
3. Xin Zhang, Liangxiu Han, Mark Robinson, Anthony Gallagher - A Gans-Based Deep Learning Framework for Automatic Subsurface Object Recognition From Ground Penetrating Radar Data *IEEE Access* (IF3.367), Pub Date : 2021-03-08*,*

*DOI:* [*10.1109/access.2021.3064205*](http://doi.org/10.1109/access.2021.3064205)

Application enquires:

[Professor Mark Robinson](https://www.ncl.ac.uk/engineering/staff/profile/markrobinson.html)

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**We will also need to link your PhD advert up to the subject keywords below so that your PhD studentship can be found on findaphd.com. Please highlight up to three relevant keywords from the lists provided below.**

* Antenna
* Subsurface Inspection
* Design

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