

# UK Metamaterials Network

## Wireless and Microwave Metamaterials - 1st SIG meeting

Held via gather.town on Wednesday 13 January 2021

**SIG Lead:** Prof Lee Ford (University of Sheffield)

**Convenor:** Dr Anja Roeding (University of Exeter)

### Group discussion participants:

<a href="#">Group A</a> <b>Chair:</b> Tom Bassett <b>Notes taken by:</b> Tom Bassett	<a href="#">Group B</a> <b>Chair:</b> Greg Smith <b>Notes taken by:</b> Miguel Navarro-Cía	<a href="#">Group C</a> <b>Chair:</b> Owen Lozman <b>Notes taken by:</b> Lee Ford
Akram Alomainy, QMUL Adam Armitage, MBDA Thomas Bassett, MBDA Fraser Burton, BT Andrew Comley, AWE Stephen Hanham, Birmingham Alastair Hibbins, Exeter Themos Kallos, Meta TK Timothy Pelham, Bristol Tim Starkey, Exeter Daniel Underhill, MBDA	Jisun Im, Nottingham Miguel Navarro-Cia, Birmingham Greg Smith, BAE Systems Oleksiy Sydoruk, Imperial Chris Worrall, TWI Ltd Amy Yuan, Glasgow Shiyu Zhang, Loughborough	Lee Ford, Sheffield Ian Hooper, Exeter Fateme Hoveizavi, CSA Catapult Owen Lozman, M-Ventures Christos Marangos, Bristol Tien Thuy Quach, Nottingham Khalid Rajab, QMUL Tom Smith, BAE Systems Gus Cheng Zhang, Manchester

**The aim of this meeting** was to bring together the Wireless and Microwave Metamaterials SIG members for an initial discussion on the current challenges of this research area in the UK, and what we as a network can do to address these challenges.

### Summary of the discussion outcomes

#### 1. What are the challenges for this research area?

- Struggle to move from research to field/applications because designs tend to be too fancy, narrowband, lossy, etc.
- Large gulf between TRL levels? This “Valley of death” needs to be bridged. Is more funding needed to help move up the TRLs?
- How to scale-up manufacturing beyond proof-of-concept, single experiment?
- Integration/practical/environmental issues for performance when scaled up - Fragility, durability - > Lifetime?
- Specific use cases must be considered early in the research cycle.
- There is a lack of a library of metamaterials, and the kinds of materials used to build them. What materials are suitable for additive manufacturing?
- (Additive manufacturing) Tolerances vs. sample size.
- The metamaterials domain is incredibly large, and there can be terminology divergence. This can limit knowledge transfer.
- Natural selection of technology can be valuable. Technology transfer must be encouraged.
- Recent move to active and reconfigurable devices and bringing them into applications. More collaboration with academia/industry needed in this area?
- Generally require a more cohesive effort across the research domain.

## 2. Are there sub-topics of high priority within this SIG?

- Reconfigurable and active structures.
- Low RCS (radar cross section), multifunctional antennas, metamaterial arrays (steering), holographic antennas, miniaturization.
- Metamaterial absorbers, multifunction metamaterials (working at different frequencies / in different fields - thermal, acoustic, EM...), surface-wave propagation.
- Healthcare technologies - metamaterials + MRI for enhanced cancer detection.
- Multiphysics modelling. Finite size issues modelling.
- Flexible/wearable meta-electronics.
- Metamaterial-enabled 5G (engage with large companies).

## 3. What are currently available capabilities within the UK? (people / facilities)?

This question could not be addressed sufficiently during the meeting time frame.

## 4. What outcomes would you like to see from this network investment, in particular in the wireless & microwave metamaterials sector?

- Industrialisation needs to be progressed. Assessment of available or upcoming manufacturing techniques.
- Putting academic proposals together; grants, fellowships, patents as measure of success
- Foster knowledge exchange
  - What research is out there now from Universities? Include poster sessions in these meetings to capture recent research.
  - Combine efforts to solve problems, rather than working on similar problems individually.
  - Libraries to help everybody (designers need reliable material properties, specs and fabrication limitations, manufacturers need to know what type of structure they should fabricate and adapt their tools (e.g. type of additive manufacturing materials suitable for metamaterials academia and industry)
  - Connect PhD students across the country (Training, development, placements)
- Bridging the gap between academia and industry:
  - Consolidation of R&D programs across the community. Early TRL → Higher TRL → Industrialisation.
  - Obtain input from industry and openness around technical challenges to enable collaboration and solving the scientific problems. (NDAs? Other ways to engage and understand problems industry is facing?)
  - Industry to pitch challenges for academia, beyond the usual calls for proposals.
  - New technologies, efficiency comparison with traditional technologies.
  - Communication of the potential of metamaterials to complement existing materials and, therefore, technologies, rather than replacing them

## 5. What activities should we run as a network over the next 3 years to work towards those outcomes?

- Networking meetings for showcasing, including **virtual poster sessions**
- Collect a list of skills & capabilities in the domain.
- Create list of challenges of the community (academia and industry), condense into a selection of larger questions to address as a community
- Can we/should we create a NDA/security cleared element of the SIG to discuss more sensitive topics and detailed problems companies face?
- Connect with other networks (e.g. semiconductor devices)