UK META MATERIALS NETWORK | Wireless and Microwave Metamaterials

Optical tuning for metasurfaces

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Lightning talk content

- Illuminating intrinsic silicon alters its resistivity
- So can control EM properties of metasurface/antenna with no complex DC biasing
- Seems to be highly linear
- Can work to v. high frequencies (how high, under study)
- Still need DC power for LEDs/lasers

Challenges:

- ➢ Manufacturability and scalability of tuneable surfaces?
- ➢ What applications are there? Commercial?

Discussion summary

<u>Group 1</u>

- Tuning mechanisms:
    - Optical tuning: How to illuminate the silicon?
        - Fibre optic cables large and bulky, so light guides? Transparent cables?
    - Semiconductors:
        - Frequency range - commercially up to 10sGHz, speciality even higher
        - Suitable foundry service in UK for high-speed devices?
    - MEMS - reliability issues? Linearity?
    - Indium Tin Oxide (ITO): Transparent thin film, ps switching
- High-speed reconfigurability:
    - Depends on application - may be sub-ns, some applications ms
    - Optical silicon - depends on carrier lifetime, high intensity increases rate
- THz range:
    - Range very short - More suitable for imaging/sensing than communications?
    - Measurement - Low powers on equipment, eg. VNAs ~10uW

<u>Group 2</u>

- High priority applications:
    - Defence sector (interest in the optical control)
    - Large intelligent surfaces
    - Reactance control
    - Applications for satellites that could be electronically steerable.
    - Wireless power transfer
    - Energy harvesting
- Fabrication/manufacturing
    - Dimensional control, how small can you go (pixel size) – maybe 100 microns, maybe an issue with conductivity (this could also be useful for lossy structures).
    - Typically, they are 1mm.
    - Limits on switching speed, if improved could open up applications such as direct antenna modulation.
    - Scale up (size, reproducibility)

Next steps

- ➢ Hear about more of the research in the UK in this area - ECR showcase?
- ➢ More focussed discussion groups on specific areas