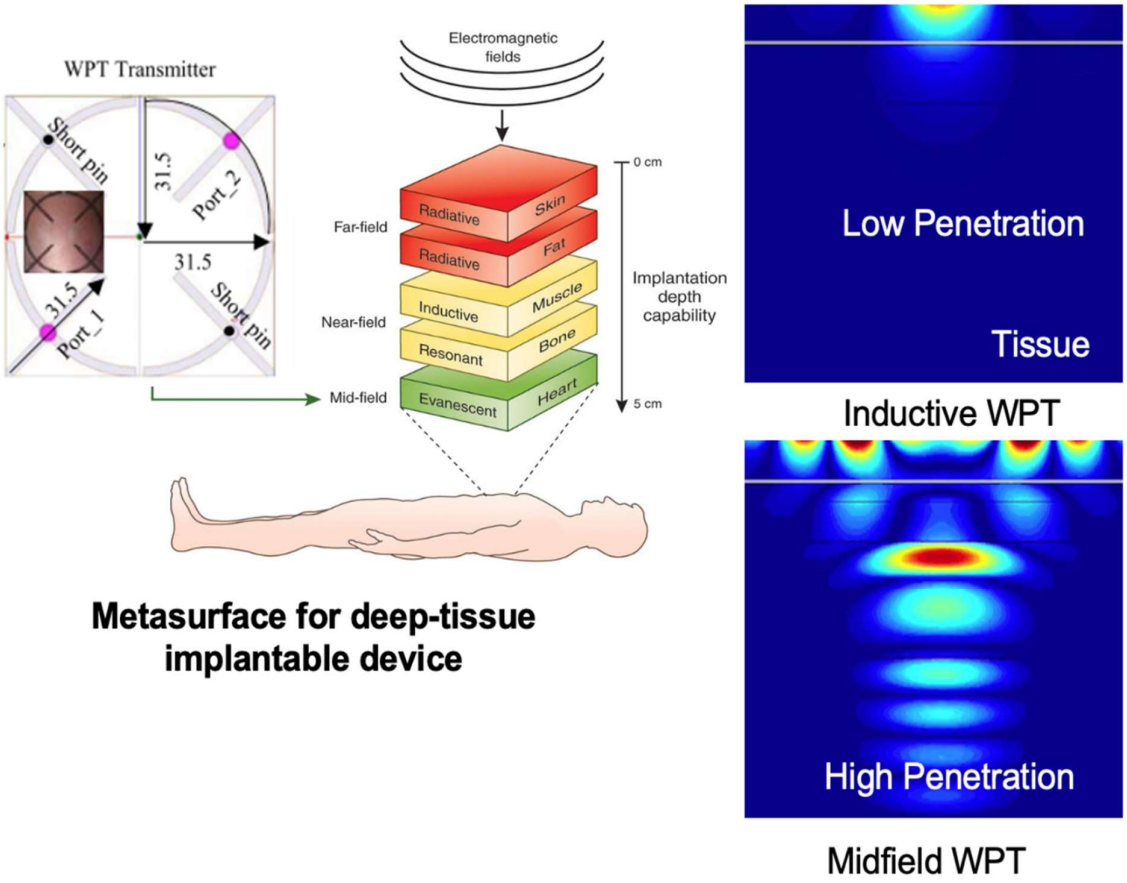
Healthcare

Flexible Metasurface to power the next-generation of implantable bioelectronic interfaces

Radiofrequency techniques are the dominant wireless technology used for bioelectronic applications due to their relative safety and maturity. These systems use components such as antennas, waveguides and phased arrays to control the propagation of electromagnetic fields, which are usually the largest and most energy-demanding part of a bioelectronic device and thus determine the safety and efficacy of the system. However, the human body is a lossy, heterogeneous and dispersive medium, presenting major challenges for wireless technologies. Biological tissues, in particular, absorb electromagnetic radiation, which must be within safety limits to prevent adverse thermal or stimulatory effects. Because tissue absorption increases with higher electromagnetic field frequencies,



Metasurface for deep-tissue implantable device

Figure 1. Patterned metasurface for powering deep-tissue biomedical devices such as cardiac pacemaker

an operating frequency of less than 5 GHz is required to access regions deep in the body. However, this requirement also limits the miniaturization of the components and the ability to focus the electromagnetic field because the wavelength in biological tissues exceeds a centimetre at such frequencies. Furthermore, the human body is in constant motion and its size and composition greatly vary between individuals. These features present formidable challenges for the design of miniaturized, robust and high-performance wireless bioelectronic components for sensing and therapy.

This objective of this research will be to explore and study the metamaterials/metasurface, which can be engineered to control electromagnetic fields around the human body and could be used to overcome the current limitations of bioelectronic interfaces.

References

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Please contact Dr Rupam Das or Prof Alastair Hibbins via metamaterials@exeter.ac.uk for more information.