

## Intelligent surfaces and fluid antenna systems – new technologies for 6G?

### Abstract

Two novel technologies being investigated for 6G are reconfigurable intelligent surfaces (RIS) and fluid antenna systems (FAS).

RIS: Essentially a panel of intelligent reflective elements, a RIS modifies the channel between transmitter and receiver without the need for extra RF chains. This makes it attractive as a low power performance enhancer. Despite its promise, there are serious challenges for RIS systems in terms of low complexity channel estimation and design.

FAS: Imagine a device where antenna element(s) are mobile, being located in a fluid and able to be moved around a defined region, powered by a pump. In the simplest case, a single antenna is moved along a tube replicating antenna selection across a linear array. Such a system has enhanced spatial selectivity, but again, channel estimation is problematic and the mechanical design is likely to be challenging.

Although very different techniques, both take advantage of spatial diversity in small volumes and it can be useful to consider the limits of both approaches in the limit as the number of elements grows large. For the RIS, this means filling the surface with more and more closely spaced reflective elements. For the FAS, this means continuous control of the antenna location over the whole region. This talk will outline the potential benefits and design challenges implicit in the RIS and FAS paradigms.

### Bio



Peter Smith (M'93–SM'01-F'15) received the B.Sc degree in Mathematics and the Ph.D degree in Statistics from the University of London, London, U.K., in 1983 and 1988, respectively. From 1983 to 1986 he was with the Telecommunications Laboratories at GEC Hirst Research Centre. From 1988 to 2001 he was a lecturer in statistics at Victoria University of Wellington, New Zealand. From 2001-2015 he worked in Electrical and Computer Engineering at the University of Canterbury. In 2015 he joined Victoria University of Wellington as Professor of Statistics. He is also an Adjunct Professor in Electrical and Computer Engineering at the University of Canterbury, New Zealand and an Honorary Professor in the School of Electronics, Electrical Engineering and Computer Science, Queens University Belfast. He was elected a Fellow of the IEEE in 2015 and in 2017 was awarded a Distinguished Visiting Fellowship by the UK based Royal Academy of Engineering at Queens University Belfast. In 2018-2019 he was awarded Visiting Fellowships at the University of Bologna, the University of Bristol and the University of Melbourne. His research interests include the statistical aspects of design, modeling and analysis for communication systems, especially antenna arrays, MIMO, cognitive radio, massive MIMO and mmWave systems. More recently, he is working in the area of reconfigurable intelligent surfaces, fluid antenna systems and joint radar/communications systems.