Wireless Channel Performance with Topological Antenna Diversity

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Background
Topological Antenna Diversity is achieved through exploitation of the Orbital Angular Momentum (OAM) of the transmitted electromagnetic wave. Topological diversity has recently been proposed as a great potential of improving the spectral efficiency (capacity) of radio transmissions [1]. OAM accounts for the phase front of the transmitted wave by providing independent phase states, thus, additional modes of propagation (degrees of freedom) resulting in independent simultaneous wireless radio links. OAM transmission has only very recently been applied to radio transmissions at much lower frequencies [1], [2], [3], [4] and, as such, these experiments raise as many questions as answers. For example, what aspects are fundamentally new? How can we best exploit this fascinating technique for realistic wireless systems? What are the benefits of OAM transmissions compared to multiple input-multiple output (MIMO) systems in terms of both simplicity and performance improvement?

Programme
The aim of this PhD is to thoroughly explore the emerging concept of topological diversity through OAM transmissions to determine what advantages it has and how it can be best exploited. This will encompass a scoping and feasibility study, as well as experimentation, and has the following milestones:
i. Report of prior art, including a scoping and feasibility study (6 months)
ii. Model OAM radio transmissions and submit the year 1 report (12 months)
iii. Investigate how OAM based radio can be exploited (24 months)
iv. Develop an experimental OAM system and test it (30 months)
v. Investigate any further techniques that would advance the understanding of OAM radio, write and submit thesis (36 months)

Impact potential

The researcher is encouraged to develop exploitable outputs. Examples pertinent to this programme of study are: concept demonstration for use in attracting further investment and patenting of novel techniques.

References