Atmospheric Turbulence Mitigation on Optical Link by Integrated Optics

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Abstract:

In order to achieve Gigabit per second data rates with ground-to-satellite downlink, the received beam must be coupled into a single mode fibre. Atmospheric turbulence causes random phase and amplitude variations, which are more pronounced the lower the satellite is on the horizon. Adaptive Optics (AO) is used to analyse and compensate for wavefront distortions in real time to maximise the coupling in the single-mode fibre. However, when the satellite is at less than 20°, the performance of conventional AO is limited, and conventional wavefront analysers are no longer usable. A new approach has been proposed: it consists of coupling the beam into an array of several single-mode fibres and then coherently combining the coupled fields with an integrated optics component. The design and test of such a photonic integrated circuit (PIC) is the main goal of this thesis.