

Harnessing multimode propagation for deep-tissue imaging

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The turbid nature of refractive index distribution within living tissues introduces severe aberrations to light propagation thereby severely compromising image reconstruction using currently available non-invasive techniques. Numerous approaches of endoscopy, based mainly on fibre bundles or GRIN-lenses, allow imaging within extended depths of turbid tissues, however their footprint causes profound mechanical damage to all overlying regions and their imaging performance is very limited.

Progress in the domain of complex photonics enabled a new generation of minimally invasive, high-resolution endoscopes by substitution of the Fourier-based image relays with a holographic control of light propagating through apparently randomizing multimode optical waveguides. This form of endo-microscopy became recently a very attractive way to provide minimally invasive insight into hard-to-access locations within living objects.

I will review our fundamental and technological progression in this domain and introduce several applications of this concept in bio-medically relevant environments.

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