

Reflection Matrix Approaches for Imaging Random Media: From Ultrasound to Optics

Mathias Fink

Langevin Institute

ESPCI Paris, PSL Research University, CNRS

1 rue Jussieu, 75005, Paris, France

Noninvasive in vivo medical imaging with light or with ultrasound requires reflection-mode detection. As tissues are complex disordered media, containing random distribution of scatterers, these techniques suffer various limitations as distortion induced by aberrating layers as well as multiple scattering contributions. Multi illumination strategy is the solution to solve these problems. We will show that recording a time-gated reflection matrix can provided enough information both on the properties of aberrating layers and on the level of multiple scattering. We will show how to extract from the coherence properties of this reflection matrix enough information both to compensate the effects of aberrating layers and to overcome the contribution of multiple scattering. Various strategies to measure this reflection matrix will be discussed and their applications will be presented both in ultrasonic imaging and in deep optical coherent tomography (OCT)