

Abstract for **Ph.D degree - Thesis**

Title: Focusing, imaging and sensing with optical scattering media

Name of Ph.D student: TRAN THE VINH

Matriculation Number: G1500745A

Centre for OptoElectronics and Biophotonics, School of EEE, Nanyang Technological University
Singapore

Supervisor: Asst. Prof. Cuong Dang, school of EEE, Nanyang Technological University Singapore

Propagation of light through scattering media such as glass diffuser or biological tissues is usually considered as a random process, challenging our optical access. My research demonstrates multiple approaches to not only overcome but also utilize the randomness of scattering media. First, I will demonstrate a phase modulation technique to focus light behind a scattering medium. Then, I will present a technique to move the focus spot swiftly in three-dimensional space behind the scattering medium by utilizing optical memory effect. With multiple focus spots, we can measure multiple point spreading functions to image the object behind the scattering medium computationally with expanded field of view. In the second part, I show a technique to utilize ground glass diffusers and their sensitivity with inhomogeneous refractive index to develop a simple and powerful optical sensor. Our detection limit of 12 ppm for glucose concentration or 3.87×10^{-6} refractive index unit is comparable to many optical resonant sensors, which require advanced manufacturing techniques.

- Key words: optical memory effect, spatial light modulation, focusing, imaging, scattering media, refractive index sensing.