

## SEMINAR ANNOUNCEMENT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING  
COLLEGE OF DESIGN AND ENGINEERING

Website: <https://cde.nus.edu.sg/ece>

**Area: Signal Analysis and Machine Intelligence (SAMI)**

**Host: Prof Biplab Sikdar**

<b>TOPIC</b>	:	<b>Computational microscopy and deep tissue imaging with optical time-reversal</b>
<b>SPEAKER</b>	:	<b>Prof Changhui Yang Executive Officer for the Electrical Engineering Department Thomas G. Myers Professor of Electrical Engineering, Bioengineering and Medical Engineering California Institute of Technology</b>
<b>DATE</b>	:	<b>Wednesday, 30 July 2025</b>
<b>TIME</b>	:	<b>3:30PM to 5:00PM</b>
<b>VENUE</b>	:	<b>E5-03-20</b>

### ABSTRACT

In the first half of this seminar, I will discuss some of our recent computational microscopy and deep learning work. The sheer level of computational resource we can access in today's world, has significantly changed the way we think about, process and interact with microscopy images. I will talk about Fourier Ptychographic Microscopy (FPM) – a novel way to collect and process microscopy data that is capable of zeroing out physical aberrations, expanding spatial bandwidth product and enabling digital refocusing. I will also talk about the use of Deep Learning in image analysis, and point out some of novel and impactful ways it is changing how we deal with image data in pathology and life science research. These surprising findings strongly indicate the need for the redesign of physical microscope systems to enable the next level of AI based image analysis. I will briefly touch on the shape and form that these redesigns might look like.

In the second half of the seminar, I will talk about my team's work in tackling the extreme turbidity associated with thick biological tissues. Here, we bank on the fact that, while optical scattering may appear random and haphazard, it is also deterministic and can be time-reversed through optical phase conjugation. I will discuss how we use ultrasound tagging in combination with digital optical phase conjugation to focus light tightly and deeply within biological tissues. This technology enables targeted optogenetic activation and high-resolution tissue imaging at an unprecedented resolution-and-depth combination.

### BIOGRAPHY

Changhui Yang is the Thomas G. Myers Professor of Electrical Engineering, Bioengineering and Medical Engineering at the California Institute of Technology. He is currently the executive officer of the Caltech EE department. Yang works on computational imaging and the use of deep neural networks for image analysis, and time-reversal wavefront shaping for deep tissue imaging. His research team has developed numerous novel biomedical imaging technologies over the past 2 decades – including technologies for focusing light deeply into animals using time-reversal optical methods, lensless microscopy, ePetri, Fourier Ptychography, and non-invasive brain activity monitoring methods. He has worked with major companies, including BioRad, Amgen and Micron-Aptina, to develop solutions for their technological challenges.

He has received the NSF Career Award, the Coulter Foundation Early Career Phase I and II Awards, and the NIH Director's New Innovator Award. He is a Coulter Fellow, an AIMBE Fellow and an OSA Fellow. He was inducted as a Fellow in the National Academy of Inventors in 2020.

<https://cde.nus.edu.sg/ece/highlights/events/>