T4: Optical Methods in Oceanography

Dr. Weilin “Will” Hou

Outline of the course

This course covers basic principles and applications of optical oceanography. The course is aimed to provide background information for those interested in exploring processes involving the ocean using optical techniques, including sensing and monitoring via remotely (passive and active), as well as traditional in situ measurement and sampling approaches. A brief introduction of oceanography will be given, followed by ocean optics principles include scattering by both particles and optical turbulence, polarization and impacts on underwater imaging and communication, through theoretical frame work and examples. Typical sensors and platforms including unmanned underwater vehicles are introduced. Topics associated with data collection, processing, analysis, fusion and assimilation to ocean models are also discussed. This course can also be used as a refresher for recent advances in related areas. This course helps to understand apply to research and development efforts relevant to the maritime environment, in such issues as sea surface temperature sensing, underwater imaging, and remote sensing including water quality monitoring related to biological activities or extreme events, for example.

LEARNING OUTCOMES

This course will enable you to:

- grasp core concepts and fundamentals of oceanography, including key concepts in physical, chemical, biological and geological ocean research. The background information provided is the key to the understanding and appreciation of ocean sensing techniques and instrumentation developed.

- assess the basic principles and challenges associated with ocean sensing and monitoring with optical methods, including remote sensing and in situ sampling methods

- understand recent advances in sensing platforms including unmanned aerial/ underwater vehicles, and monitoring networks

- gain new understanding of visibility theory from a MTF perspective, which can be

used to estimate imaging system performance during design and evaluation phase, particularly under different turbidity and turbulence conditions

INTENDED AUDIENCE

Scientists, engineers, technicians, or managers who wish to learn how to apply their technology to monitor 72% of the earth surface, to know more about how to quantify visibility, ocean color, bottom type, and other oceanic phenomenon such as targets, currents, waves, temperature, wind and salinity. Undergraduate training in engineering or science is assumed.

COURSE LEVEL

Introductory

INSTRUCTOR

Weilin “Will” Hou has been involved in R&D in optics and oceanography for the past twenty years, with diverse background on many topics including lidar, remote sensing, underwater visibility theories and imaging systems, in situ measurements, and turbulence. He is currently an oceanographer and the head of the Hydro Optics, Sensors and Systems Section at the U. S. Naval Research Laboratory. He earned his PhD in Oceanography at the University of South Florida in 1997. He is the editor of 9 SPIE proceedings. He has 7 patents and over 60 publications. He is a senior member of IEEE and a Fellow of SPIE.

ADDITIONAL NOTES

I could include my book as part of the course offered: Ocean Sensing and Monitoring: Optics and Other Methods (SPIE Press, 2013), by Weilin Hou.