



Today's technology for a sustainable future

TUTORIAL 1 & 2 TRM1 & TRM2

TITLE: Acoustic time reversal: TRM 1: Theory, TRM 2: Marine applications

INSTRUCTORS: Mathias Fink (1) & William A. Kuperman (2)

ABSTRACT

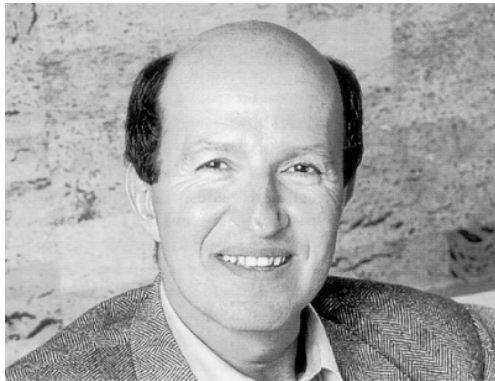
To provide the acoustical physics overview and description of the experimental implementation of time reversal and phase conjugate processes as related to ultrasonics and imaging, nondestructive testing, medical ultrasonics, propagation in random media, room acoustics, waveguides, and ocean acoustics.

An acoustic Time Reversal Mirror (TRM) refocuses an incident acoustic field to the position of the original source regardless of the complexity of the medium between this “probe” source and the TRM. TRM's have now been implemented in a variety of physical scenarios from mega Hertz ultrasonics with order centimeter aperture size to hundreds/thousands of Hz in ocean acoustics with order hundred meter aperture size.

Common to this broad range of scales is a remarkable robustness as evidenced by observations at all scales that the more complex the medium between the probe source and the TRM, the sharper the focus. The potential for applications in many areas of acoustics is quite high.

BIOGRAPHY

This course will be taught by Professors Mathias Fink of the University of Paris and William Kuperman of the University of California, San Diego.



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Mathias Fink is a Professor of Physics at the Ecole Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI) and at Paris 7 University (Denis Diderot), France. In 1990 he founded the laboratory Ondes et Acoustique at ESPCI. In 2002, he was elected at the French Academy of Technology and in 2003 at the French Academy of Science.

His current research interests include medical ultrasonic imaging, ultrasonic therapy, nondestructive testing, underwater acoustics, active control of sound and vibration, analogies between Optics and Acoustics, wave coherence in multiply scattering media and time reversal in physics. He has developed different techniques in wave focusing in inhomogeneous media, speckle reduction, and in ultrasonic laser generation. He holds 28 patents and he has published more than 300 articles.

Dr. Kuperman has spent most of his research career at the U. S. Naval Research Laboratory, SACLANT Undersea Research Centre in La Spezia, Italy and the Scripps Institution of Oceanography of the University of California, San Diego. He has done theoretical and experimental research in ocean acoustics and signal processing and has, over his career, spent more than three years at sea. Most recently, he has been involved with a series of ocean acoustic time reversal (TR) experiments and has worked on various aspects of TR from basic physics to applications of TR to SONAR and communications. Presently he is a Professor of Marine Physics at the Scripps Institution of Oceanography and Director of its Marine Physical Laboratory. He is also a co-author of the book Computational Ocean Acoustics.