

# Time Reversal - from mathematical principles to advanced application

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## **Abstract**

Building knowledge on surrounding world requires information about it. This almost trivial statement gains a much deeper sense in cases when we cannot infer thought information by direct measurements. It happens quite often. In such a case we can still gain (at least partially) thought information from observational data but it requires a more complex approach often referred to as “inverse theory”. In this talk I will present the modern inverse method called Time Reversal Mirroring (TRM) which provides an efficient way of inferring information from recorded waves provided governing equation is a linear, hyperbolic PDE. From the physical point of view the method is based on two basic symmetries of underlying equation(s): time reversal and source-receiver reciprocity. They allow to construct an extremely efficient numerical algorithm for analyzes of complex time series data in searching for “hidden” information about waves source and/or medium properties.

My talk begin from basic mathematical principle upon which the TRM method is build up. At this point I will also point out limitation of the method. Next I will give a short overview of idea of “inverse problems” and how TRM fits to this framework. In the second part I will discuss the particular applications of TRM method, namely the source location task.

Since this talk was inspired by a presentation by Prof A. Królak at the previous seminar of the series I will be glad finally to discuss about possibility of using the method for cosmological (gravitational waves description) applications.