INVERSE METHODS IN HEAT TRANSFER THROUGH MODELLING AND MACHINE LEARNING

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ABSTRACT The re-emergence of machine learning methods creates many opportunities for the heat transfer community to transform understanding of heat transfer topics and heat transfer equipment design. The data-rich area the heat transfer researchers have created in the last fifty years enhances the opportunity to provide a new way of assembling information. More use of the connected world will reduce the need for duplicating or repeating experiments unnecessarily. This lecture will discuss a framework to use data more effectively in an inverse setting.

While the heat transfer community has been working hard on inverse problems, many issues such as multiple solutions and convergence are not fully resolved. These issues can be turned around into advantage when using machine learning. For example, multiple solutions can be an advantage in providing multiple choices of design. Thus, exploring machine learning options to carry out inverse modelling in heat transfer is important.

The first part of the talk will use simple examples of heat transfer and other problems to demonstrate how one can use machine learning in inverse modelling. Besides, how we can fill the data gap using a computational model will also be discussed. The talk will end with how the compact heat exchangers' data-rich area can benefit enormously from the available data if it can be gathered together. For example, the work will also demonstrate a forward deep learning method for offset strip fin heat exchangers.