Using Machine Learning Methods in The Simulation of Heat Transfer and Fluid Flow: a Brief Review

Minshan Li[1,3], Dongchuan Mo[2,3*] and Shushen Lyu[2,3*]

1 School of Chemical Engineering and Technology, Sun Yat-sen University, Guangzhou, 510275, China.

2 School of Materials, Sun Yat-sen University, Guangzhou510275, China.

3 Guangdong Engineering Technology Research Centre for Advanced Thermal Control Material and System Integration (ATCMSI), Guangzhou 510275, China.

*Corresponding Authors: Dongchuan Mo. Email: modongch@mail.sysu.edu.cn; Shushen Lyu. Email: lvshsh@mail.sysu.edu.cn.

Abstract: In the past few years, machine learning algorithms and models have shown great power in the emerging field of data mining and artificial intelligence, attracting a great deal of attention. Given specific learning task and training data set, a machine learning model can improve automatically through training and can help people make decisions and predictions. To date, a lot of advanced machine learning algorithms and theories have been proposed and developed, including random forest, support vector machine, artificial neural network, deep learning and so on. Well-chosen and well-trained machine learning model is proved to have high efficiency, accuracy and robustness, and is particularly useful in fields where the fundamental mechanisms are difficult to study and yet not thoroughly understood. Recently, some of these machine learning methods are adopted in the research of heat transfer and fluid flow and have achieved superior performance in comparison with conventional empirical models. In this review, we introduce some machine learning algorithms and models that are commonly used in the simulation of heat transfer and fluid flow. Then, the process of applying these methods are discussed in detail. While the role of machine learning methods in fundamental scientific and engineering research remains to be investigated, the combination is supposed to bring new insight into these fields.