

High Performance Computing and Machine Learning Applied in Thermal Systems Analysis

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The efficient monitoring and control of a thermal system is highly desirable in many industrial applications. Such applications can be found, for instance, in the design process of aircraft/spacecraft body parts where the properties of materials are important for local heat transfer under the thermal yield constraint of the same. However, of the bottle necks that make these types of problems difficult to handle are their multi-physics (fluid flow, heat transfer, mass transport, local material heterogeneity, etc.) and their hierarchical multi-scale (i.e. micro, meso and macro) characteristics. This limits the applicability of experimental approach due to high expenses and accessibility the data at different length/time scales.

With the recent advancements in the computer technology, it is now become possible to use this data driven technologies. This is because in one hand the data-driven and machine learning (ML) approaches are evolved for thermal engineering applications and, on the other hand, the big high-performance computing (HPC) resources are available for massively producing the costly simulation data. Although this methodology achieved significant success across many areas, the engineering sciences so far primarily focused on physically interpretable methods. Therefore, this mini-symposium (MS) aims at gathering the efforts regarding the development and applications of data driven approaches in analyzing the thermal systems. As such we are interested, but not limited, to the original manuscripts and review reports on the following fields:

- Machine Learning Methods Applied in Thermal Systems
- Prediction of a Thermal Behavior of a System Using Data-Driven Approaches
- High Performance Computing of Thermal Systems
- Real-Time Analysis of a Thermal System
- Validation and Optimization of Data-Driven Approaches against Analytical/Experimental Approaches

It is noted that producing new data-bases that can be utilized for the training and prediction of thermal behavior of different systems using machine learning is also of interest of current MS.