



## EXPLORING ARTIFICIAL INTELLIGENCE APPLICATIONS TO HEAT TRANSFER: THE GOOD, THE BAD, THE HYBRID

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### ABSTRACT

Artificial Intelligence (AI) has disrupted several industries and for very good reasons. AI algorithms, combined with large computational power and scalability of the cloud are capable of finding non-obvious correlations in a large amount of data, predict future trends and help optimise various types of operations.

Several success stories of AI applications in our daily lives range from facial recognition to language translators and digital assistants. In science and business, AI has helped multiple industries including medicine (e.g. medical records mining, assistance to doctors in diagnosis and surgery, better drug development in minimal time), marketing (e.g. predicting customer behaviour) and is making strides with autonomous vehicles and even general AI, a human-like artificial intelligence capable of understanding and learning any intellectual task that a human brain can.

What about Thermal Systems? In this lecture, we will discuss the benefits and limitations of AI algorithms over traditional deterministic (physics based) models when applied to thermal systems. We will also discuss how more advanced approaches such as Physics-informed AI and Hybrid-AI which combine the power and scalability of AI with the robustness of deterministic models are currently being used to overcome the traditional limitations of AI methods.

Finally, we will use real-world examples that range from microscale phenomena (e.g. Pulsating Heat Pipes) to industrial applications (e.g. Heat Exchanger Networks) to illustrate the current capabilities of the methods, their limitations, and their true potential to revolutionise the heat transfer sector.