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Editorial

Editorial for Special Issue: "Heat Transfer Processes in Oscillatory Flow Conditions"

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Heat exchange processes in steady flows have been studied extensively over the last two hundred years, and are now part of undergraduate syllabi of most engineering courses. However, heat transfer processes in oscillatory flow conditions are still not very well understood. Their importance is well recognized in applications including Stirling machines, thermoacoustic engines, and refrigerators or pulsed-tube coolers in cryogenics. Additionally, the enhancement of heat transfer by using oscillatory, and, in some cases, pulsating flows is important in many areas of mechanical and chemical engineering for the intensification of heat transfer processes and possible miniaturization of heat exchangers of the future.

This special issue was intended as a dissemination platform for researchers working in the field to give an opportunity to consolidate the recent advances in this important research field. All types of research approaches were invited, including experimental, theoretical, computational fluid dynamics (CFD), and their mixtures, while the approaches could be both of a fundamental and applied nature. The heat transfer phenomena could be analysed from both the global (macroscopic) perspective, for instance whole heat exchanger units working in an oscillatory flow regime, and the local (microscopic) perspective, for instance the fundamentals of heat transfer in individual channels where such processes occur in an oscillatory flow regime. Invitation was also open to all disciplines, including, but not limited to, engineering, physics and chemistry, and biological and medical sciences—the underlying theme being simply heat transfer processes in oscillatory flow conditions.

The response to this invitation was very impressive—we received over 20 manuscripts. A strict refereeing process adopted by *Applied Sciences* meant that only 10 papers made it to the final special issue. Also, in the process, some papers were judged not suitable for the special issue, but generally of suitable standard for the regular issues of *Applied Sciences* and these were transferred over to alternative editors and subsequently published elsewhere. Publishing this special issue was of course a team effort, and thanks are due to all involved, in particular a group of reviewers who have to remain anonymous, my colleagues from the editorial board: Professor Yulong Ding (University of Birmingham, Birmingham, UK) and Professor Vitalyi Gusev (Université du Maine, Le Mans, France), and the tireless editorial team led by Ms. Xiaoyan Chen, without whom the special issue would have never succeeded.

Clearly, the majority of papers in this special issue (eight out of 10) deal with heat exchange processes in the context of Stirling, thermoacoustic, and pulse tube devices. These could be (somewhat arbitrarily) divided into a few themes:

The first theme is related to experimental investigations of the performance of heat exchangers in oscillatory flow conditions with the following papers:

- A Comprehensive Empirical Correlation for Finned Heat Exchangers with Parallel Plates Working in Oscillating Flow by Huang et al. [1]

- Influence of the Water-Cooled Heat Exchanger on the Performance of a Pulse Tube Refrigerator by Wang et al. [2]
- Comparative Performance of Thermoacoustic Heat Exchangers with Different Pore Geometries in Oscillatory Flow. Implementation of Experimental Techniques by Piccolo et al. [3]

The common denominator here is an attempt to quantify the heat exchanger performance by means of either a criterial equation or comparisons between various heat exchanger designs and/or geometries from the point of view of their usefulness to the overall system. A second theme represents an extension of such heat exchanger studies by the application of CFD methods, which look at the physics of the underlying processes taking place in the heat exchanger vicinity. Here, two representative papers are:

- The Effect of Temperature Field on Low Amplitude Oscillatory Flow within a Parallel-Plate Heat Exchanger in a Standing Wave Thermoacoustic System by Mohd Saat and Jaworski [4]
- Numerical Predictions of Early Stage Turbulence in Oscillatory Flow across Parallel-Plate Heat Exchangers of a Thermoacoustic System by Mohd Saat and Jaworski [5]

In addition to the above studies of heat exchangers, the third theme of papers looks at the thermal-fluid processes in the regenerator materials. This includes the experimental approaches as well as simplified one-dimensional and more complex two-dimensional CFD approaches, represented respectively by the following papers:

- Measurement of Heat Flow Transmitted through a Stacked-Screen Regenerator of Thermoacoustic Engine by Hsu and Biwa [6]
- Modeling of Heat Transfer and Oscillating Flow in the Regenerator of a Pulse Tube Cryocooler Operating at 50 Hz by Liu et al. [7]
- Friction Factor Correlation for Regenerator Working in a Travelling-Wave Thermoacoustic System by Mohd Saat and Jaworski [8]

Last, but not least, two papers were outside the area of "thermodynamic machines" described above, but rather focused on the fundamental (and mostly theoretical) studies in the general chemical engineering context where oscillatory phenomena coupled with heat transfer processes play a vital role. These two papers include:

- Excitation of Surface Waves Due to Thermocapillary Effects on a Stably Stratified Fluid Layer by Zimmerman and Rees [9]
- Heat Transfer Investigation of the Unsteady Thin Film Flow of Williamson Fluid Past an Inclined and Oscillating Moving Plate by Gul et al. [10]

The guest editor and the editorial team of *Applied Sciences* hope that the readership will find the selection of articles presented here a useful contribution to the emerging field of heat transfer processes in oscillatory flow conditions.

Conflicts of Interest: The author declares no conflicts of interest.

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