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Numerical Study of Single Stage Travelling Wave Thermoacoustic Generator Through Regenerator Optimization

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Clean energy has become a key factor in the modern world due to the lack of sustainable and clean energy sources. Low-grade thermal energy sources are common in the world and have the potential to fulfil a significant amount of energy demand. The thermoacoustic technology can be utilized to convert low-grade waste heat into acoustic and then into electricity without involving any environmental destruction. Due to the potential of the development of a sustainable energy system, thermoacoustic has become an emerging modern technology. Compared to the standing wave thermoacoustic devices, the travelling wave devices are more efficient due to their phases of pressure and velocity being in the same phase. Research is being carried out worldwide and the effect of the design parameters towards on the energy conversion efficiency of the device needs to be analyzed further. In this study, a single-stage travelling wave thermoacoustic engine was analyzed utilizing an existing computational model that has been validated with experimental data and discussed in literature. The diameter of the regenerator towards the energy conversion efficiency was analyzed. In compliance with the simulation data, a diameter of the regenerator was found to have given a minimum energy conversion efficiency, except, at that point, the conversion efficiency gradually increased by either increasing or decreasing the diameter of the regenerator. During the study, the length of the regenerator and the temperature of the hot heat exchanger were kept constant.

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