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Design of thermal boost chopper for power-amplification control of thermoacoustic engines via thermal-inertia materials

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With the advent of thermally inductive materials, it becomes possible to design a thermal boost chopper for thermoacoustic engines as an electrical analogy to a boost converter. In the design, a thermal relay is chosen as the switching device and the thermally inductive material is to store-deliver heat-flux along with the on-off of thermal relay in a cycle. According to the principle of step-up choppers, the temperature gradients from the thermal storage to the resonator at their interface is impulsively large by which a vigorous stream of heat-flux will then be pumped into the resonator at the frequency of thermal-relay switching. This prodigiously drives up the power rating of thermoacoustic engines. Meanwhile, the switching of thermal-relay will be kept at resonance all the time for the maximum power factor in the thermal-to-acoustic conversion. The thermal boost chopper not only increases power-ratings but also enlarges application scope as stated in the following: When it is applied to a stand-alone AC solar-power generator, its power-rating is at least several times of the prior designs of active thermoacoustic engines. For an ideal matching with the resonator and the AC current generator, the power amplification can even be hundreds of times. It can also be employed to recycle dissipated heat out of manufacture processes to electricity which greatly widens the application scope. Moreover, it makes possible to replace the passive thermoacoustic engines dependent down from photovoltaic panels by active ones.

Biography

Boe-Shong Hong has completed his PhD from The PennState University at University Park, USA and Postdoctoral study therefrom. He is currently a Professor at the Department of Mechanical Engineering of National Chung Cheng University in Taiwan. He has published more than 50 papers in reputed journals and served as one of Associate Editors in some journals.

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