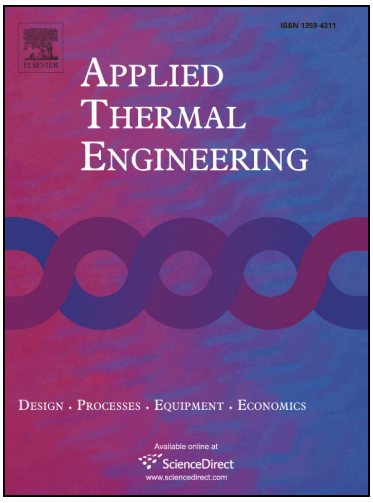

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Dynamic Performance Analysis of Solar Organic Rankine Cycle with Thermal Energy Storage

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Highlights

A dynamic model of SORC was developed considering time-varying solar radiation.

The factor *FSR* was defined to reflect the effect of TES on dynamic impact.

Resonance occurs by the combined effect of TES capacity and solar disturbance.

Abstract

This paper discusses the dynamic performance in a small-scale solar organic Rankine cycle (SORC) with thermal energy storage (TES) considering solar disturbance. A dynamic model of SORC is developed. The factor *FSR* (Fluctuation Suppression Ratio) is defined to reflect the effect of TES on suppressing the dynamic impact. The dynamics of the SORC are found to contain resonance characteristics. With the interaction between solar disturbances and system thermal inertia (mainly determined by TES capacity), the energy superposition could cause dynamic resonance. In order to study the dynamic performance of the SORC, the influence factor including TES capacity, solar fluctuation (period, amplitude, average solar) and evaporation temperature were analysed, while FSR and the total system efficiency were the indicators which represent the system stability and performance respectively. The simulation result shows that within a certain solar period, there is a specific TES capacity range leading to resonance. The proper TES capacity should be selected according to local solar fluctuations to effectively suppress dynamic impact in the initial design phase.

Keywords:

ORC, Thermal Energy Storage, Dynamic performance, Disturbance, Solar energy

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