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First and Second Analysis on the Reheat Organic Rankine Cycle

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Abstract : In recent years the increasing use of fossil fuels has led to various environmental problems including urban pollution, ozone layer depletion and acid rains. Moreover, with the increased number of industrial centers and higher consumption of these fuels, the end point of the fossil energy reserves has become more evident. Considering the environmental pollution caused by fossil fuels and their limited availability, renewable sources can be considered as the main substitute for non-renewable resources. One of these resources is the Organic Rankine Cycles (ORCs). These cycles while having high safety, have low maintenance requirements. Combining the ORCs with other systems, such as ejector and reheater will increase overall cycle efficiency. In this study, ejector and reheater are used to improve the thermal efficiency (ηth), exergy efficiency (η_ex) and net output power (w_net); therefore, the ORCs with reheater (RORCs) are proposed. A computational program has been developed to calculate the thermodynamic parameters required in Engineering Equations Solver (EES). In this program, the analysis of the first and second law in RORC is conducted, and a comparison is made between them and the ORCs with Ejector (EORC). R245fa is selected as the working fluid and water is chosen as low temperature heat source with a temperature of 95 °C and a mass transfer rate of 1 kg/s. The pressures of the second evaporator and reheater are optimized in terms of maximum exergy efficiency. The environment is at 298.15 k and at 101.325 kpa. The results indicate that the thermodynamic parameters in the RORC have improved compared to EORC.

Keywords : Organic Rankine Cycle (ORC), Organic Rankine Cycle with Reheater (RORC), Organic Rankine Cycle with Ejector (EORC), exergy efficiency
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