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Modelling of organic Rankine cycle power systems in off-design conditions: an experimentally-validated comparative study

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Abstract

Because of environmental issues and the depletion of fossil fuels, the world energy sector is undergoing many changes toward increased sustainability. Among the many fields of research and development, power generation from low-grade heat sources is gaining interest and the organic Rankine cycle (ORC) is seen as one of the most promising technologies for such applications. In this paper, it is proposed to perform an experimentally-validated comparison of different modelling methods for the off-design simulation of ORC-based power systems. To this end, three types of modelling paradigms (namely a constant-efficiency method, a polynomial-based method and a semi-empirical method) are compared both in terms of their fitting and extrapolation capabilities. Post-processed measurements gathered on two experimental ORC facilities are used as reference for the models calibration and evaluation. The study is first applied at a component level (i.e. each component is analysed individually) and then extended to the characterization of the entire organic Rankine cycle power systems. Benefits and limitations of each modelling method are discussed. The results show that semi-empirical models are the most reliable for simulating the

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