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Regenerated air cycle potentials in heat pump applications**Han Yuan, Chun-Lu Zhang****School of Mechanical Engineering, Tongji University, Shanghai, 201804, China*

Abstract Air (reversed Brayton) cycle has been utilized in the area of refrigeration and cryogenics for several decades, but its potentials in heat pump applications were longtime underestimated. In this paper, a thermodynamic model for the regenerated air heat pump cycle with practical compressor, expander and regenerated heat exchanger was developed. Based on the model, the relations between the system performance and the operating parameters were analyzed. The optimal heating COP (coefficient of performance) and the corresponding pressure ratio were derived. Then, air heat pump cycles (regenerated cycle and basic cycle) and vapor-compression heat pump cycles (CO₂ trans-critical cycle and R410A subcritical cycle) were numerically compared. The results indicated that the regenerated air heat pump cycle not only gets the heating capacity in line with the heating load under different operating conditions but also achieves higher COP over trans-critical CO₂ heat pump cycle in applications of large temperature difference.

Keywords Air cycle; CO₂ cycle; Heat pump; Model

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