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# A porous media approach for numerical simulations of the rotary thermal regenerator performance

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The experimental investigations of rotating heat exchangers are usually too costly and provide a limited understanding for the phenomena of heat and fluid flow within them; hence, a less expensive and more comprehensive method is required to investigate what can affect their overall performance. In the current study, a porous media concept is presented as an alternative way to numerically analyse the fluid flow and heat transport through a rotary thermal regenerator. An aluminum core formed of multi-packed passages is simulated as a porous medium of an orthotropic porosity in order to allow the counter-flowing streams to flow in a way similar to that inside the regenerator core. The geometric properties of the core were transformed into the conventional porous media parameters such as the permeability and the inertial coefficient based on empirical equations; so, the core has been dealt with as a porous medium of known features. Fluid and solid phases are assumed to be in a local thermal non-equilibrium state with each other; so, heat is allowed to be exchanged between them and can be tracked by creating a heat exchanger interface in the core region. A commercial CFD code "STAR CCM+" was used to solve the current problem numerically. The results are presented by means of overall temperature effectiveness, pressure drop, and the relative output power. The use of porous media approach has been found to be sufficient to solve the current problem. The data obtained reveals an obvious impact of the core geometrical parameters on both the heat restored and the pressure loss; and hence, the overall efficiency of the regenerator system.

**Keywords**: Porous Media; Regenerator; Core Geometry; Effectiveness; Pressure Loss