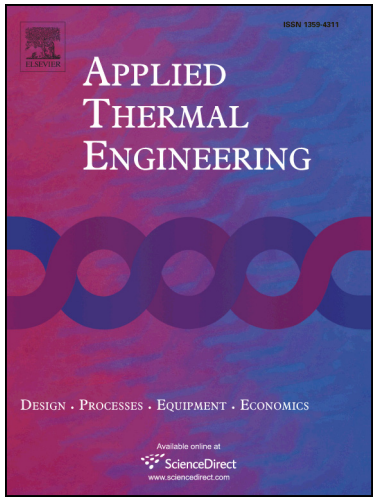

Analysis and optimum design for the transient thermal process of a two-stage compressor under alternating working conditions

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Analysis and optimum design for the transient thermal process of a two-stage compressor under alternating working conditions

Abbreviated title: Transient thermal process design

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Abstract

Because of the limitations of isobaric ratio designs of two-stage compressors, this paper presents a new method for mathematically modeling the compressor's transient thermal processes. The model divides the whole working process into seven cases based on the different air quality exchanges among the high- and low-pressure cylinders and storage tank. Expansion, compression, exhaust, and suction equations for high- and low-pressure cylinders were established under several conditions to better describe the actual operation of the two-stage compressor. Programming was performed with C and MATLAB; a computational analysis was performed on the transient thermal process of the two-stage compressor to obtain optimized the structural parameters of the two-stage compressor. An experiment was performed to compare two-stage compressors designed according to the isobaric ratio and the proposed transient thermal simulation. The experimental results showed that the two-stage compressor designed based on the transient calculation had a lower power consumption under the same displacement and backpressure conditions. Therefore, the proposed method for analyzing the transient thermal process is of significant relevance to compressor design optimization.

Keywords: compressor, isobaric ratio design, transient thermal process, structural parameter