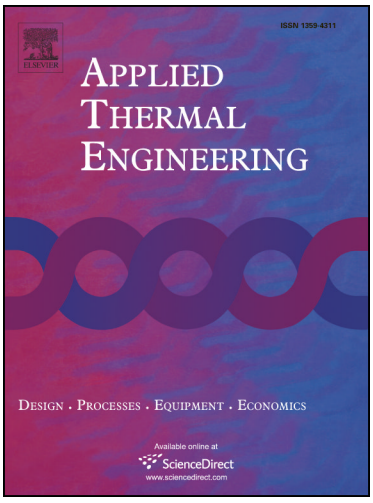

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Active Coolant Strategy for Thermal Balance Control of Motorized Spindle Unit

Yifan Zhang[1], Teng Liu[2, 3*], Weiguo Gao[2], Yanling Tian[2, 5], Xiangyang Qi[4], Ping Wang[1] and Dawei Zhang[2]

[1] *School of Electrical and Information Engineering, Tianjin University, Tianjin 300072, China*

[2] *Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin 300355, China*

[3] *School of Mechanical Engineering, Hebei University of Technology, Tianjin 300130, China*

[4] *School of Mechanical Engineering, Tianjin Polytechnic University, Tianjin 300387, China*

[5] *School of Engineering, University of Warwick, Coventry, CV4 7AL, UK*

Highlights

Power equality of spindle heat generation/ambient heat convection/coolant dissipation

Realization/advantage of active coolant strategy for spindle thermal balance control

Disturbance onto spindle accuracy from time variance of ambient heat convection

Abstract: For the precision machining activity, the accuracy of motorized spindle unit can generally be influenced by ambient heat convection and spindle heat generations. This paper develops an active coolant strategy for spindle thermal balance control, to dissipate accurately disturbing heat transfers above. Analytical relationship among spindle internal heat generation, external heat convection and coolant heat dissipation is established. This modeling illustrates that spindle thermal errors can be actively corrected by the real time monitoring - decision making - eliminating method onto spindle structural temperature. Then this active coolant strategy is realized by a developing application of differentiated multi-loops bath recirculation system. Consequently, based on a workshop with about 3.5℃ ambient temperature time variance, advantages of the active coolant strategy are experimentally verified: Compared with previous strategy, the proposed strategy is more advantageous in aspects of spindle structural heat exchange and thermal error corrections.

Keywords: Active coolant strategy; Thermal balance control; Motorized spindle unit; Time variance of ambient temperature; Thermal error