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Dynamic secondary cooling control with incremental PID algorithm in continuous bloom casting

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ABSTRACT

An incremental PID control algorithm based on the heat transfer and solidification model is presented to optimize the strand surface temperature and solidification end during the Dynamic Secondary Cooling of continuous bloom casting. This algorithm is applied to automatically adjust the water flow rate of each secondary cooling zone so as to ensure that the strand surface temperature meets the requirement of product quality. The response of the strand surface temperature and the related secondary cooling water flow rate to the casting speed is investigated, and the performance of the control algorithm is analyzed. The results indicate that the robust control performance can ensure the requirements of water flow rate dynamic adjustment in the secondary cooling zone of continuous casting. In addition, the relation between the casting speed and liquid core length of the strand is found according to the analysis of liquid core length at different casting speeds. The function is built for explaining the relation between casting speed and water flowrate, which can be a guidance of static water flowrate in the continuous casting practice.

KEYWORDS: continuous bloom casting, dynamic secondary cooling, heat transfer model incremental PID