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An analytic modeling the air-mist cooling for continuous cast slabs

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Despite the extensive use of the air-mist secondary cooling (SC) the continuous cast slabs (CCS) some drawbacks of the existing control models are still unrepaired:- big amount of online numeric calculations to specify the real-time values of the SC characteristics: slab temperature profile, water flow rate, heat transfer coefficient etc.; - fully empirical nature of the currently applied necessary relations between the corresponding technological parameters; - possibility of nonlinear phenomena or processes development during the SC that leads to violations of the "additivity" rule and decreases accuracy of the control. Aim of the research is to show possibility to improve the steel slab caster productivity, SC control effectiveness and finished slab quality by application of early developed model for the air-mist cooling, based on meeting the "mixture" rule requirements. A new "one-equation" approach is developed to determine the air-mist cooling characteristics analytically. It utilizes the main equation that provides defining the air-mist supply conditions to avoid the nonlinear phenomena appearance during the cooling. The equation is also adjusted to take into account the heat transfer and related processes development. Cooling time or secondary cooling zone length analytical distributions are obtained for basic SC characteristics. Function relations between the relevant technology parameters are also derived. High stability of the main secondary cooling characteristics under the typical casting speed fluctuations is shown. The approach provides improving the cooling control effectiveness due to decreasing the on-line calculation amount in comparing with currently applied numerical on-line solving the systems of differential equations. Improvements of the caster productivity and finished slab quality are grounded to obtain

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