Computer Algebraic Online Simulation Model of the Flux Film in Continuous Casting Moulds

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By means of computer algebra the mathematical method of analytical approximation is an approach to solve the basic differential equations of heat transfer in continuous casting moulds. This enables online simulation of the flux film thickness between copper plate and strand shell. In industrial applications the proportions of liquid, mushy and solid flux film and the variation from meniscus to the end of mould are calculated online from the caster operation data and displayed on the computer screen. As the mentioned model is based on analytic algorithm developement, it naturally provides the possibility of inverse modelling and parameter studies, even during online operation of the software. The visualization of model results can be retrieved as two- or three-dimensional diagramms immediately upon the entry of the process data. The simulation model also displays all other process-relevant results, such as strand shell thickness, strand surface temperature, local and integral heat flux densities, water temperature in the cooling channels, copper plate temperatures of hot face and cold face and an estimation of thermocouple readings (if available), etc.. One of the most interesting applications of continuous casting simulation is the prediction of unstable casting conditions such as stickers, break outs and longitudinal cracks. Trial runs at a continuous slab caster reveal that the online simulation model creates new valuable informations regarding the flux film, which might lead to an improvement in existing sticker detection systems and in the classification of operating conditions by means of ternary diagrams of three newly discovered dimensionless meniscus parameters.

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