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SEGREGATED APPROACH FOR THE MODELING OF CONTINUOUS HEAT TREATMENT FURNACES

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ABSTRACT. Accurate modeling of the transient material temperature distribution inside the continuous heat treatment furnaces are very critical in terms of adjusting the process parameters of the furnace operations. In this study the transient heating process inside the heating section of continuous glass annealing furnace is simulated using a segregated approach. Convective heat transfer inside the furnace is modeled using a steady-state solver in the Eulerian frame of reference and the transient conduction problem inside the moving glasses is using a separate transient solver in Lagrangian frame of reference. Radiation heat transfer between the glasses and the furnace is modeled using a graphics processor accelerated Monte Carlo ray tracing based surface-to-surface radiation model. The glass and furnace surfaces are taken as black in the considered scenario. The segregated approach is evaluated to be suitable as a modeling approach in terms of the convergence rate. Due to the fast convergence rate of the method and acceleration of the MCRT solver, the present heating process can be simulated in around 2 hours of computational time. Finally, the observed non-uniformity in the glass temperature distributions at the furnace outlet are quantified and the possible causes of this non-uniformity are discussed.