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Optimization of the rhomboidity of continuously cast billets using linear regression and genetic programming: A real industrial study

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ABSTRACT

During the continuous casting of steel billets, several geometrical, inner and surface defects can occur due to the thermomechanical behavior during solidification. One of them is rhombic distortion (i.e. rhomboidity), which can lead to the occurrence of off-corner cracks and twisting of cast billets during further plastic deformation (i.e. rolling). Based on data of 2088 cast batches (64 different hypoeutectoid steel grades), 109,514 billets, produced from January 2022 to September 2022 in Štore Steel Ltd. (Slovenia), chemical composition (content of C, Si, Mn, S, Cr, Mo, Ni and V), casting parameters (average casting temperature, average difference between input and output cooling water, melt level, average cooling water flow and pressure in the first and second zone of secondary cooling) the linear regression and genetic programming were used in order to predict rhomboidity of continuously cast billets. The rhomboidity, in our case defined as relative diagonal difference, was determined using in-house developed computer vision system for measuring of rhomboidity. Based on the modelling results 9 batches (419 billets) of 42CrMos4 were cast in September 2022 with a 10 % higher water pressure in the first zone of secondary cooling (from 2.41 bar to 2.67 bar). The rhomboidity of continuously cast billets improved by 18.18 % (from 1.43 % to 1.21).

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