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Development of an AI model to optimize cooling conditions for hot-rolled coils from the down coiler to the storage yard to minimize material properties deviations in high-strength steel

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In high-strength dual phase steel, where phase transformation continues even after the down coiling process in hot rolling, material deviation in the hot-rolled coil occurs due to differences in cooling rates in the radial and circumferential directions during the cooling process. This material deviation leads to short-cycle hunting of rolling load during the subsequent cold rolling process, ultimately resulting in product thickness defects and reduced cold rolling productivity.
Excessive cold rolling load hunting occurs in about 50% of the coils produced, and analyzing the causes of rolling load hunting is challenging due to the numerous related variables. Our research team developed an AI deep learning model to identify the correlation between the cooling history after coiling and rolling load hunting and derived optimal cooling conditions.
The detailed implementation of this study is as follows:
1. Data Collection and Preparation: We precisely established the coil position in the hot-rolled coil storage yard and developed a detailed cooling history management database to create input variables for the AI model.
2. Quantification of Output Variables: We developed a method to accurately quantify the amount of cold rolling load hunting, which serves as the output variable of the AI model.
3. AI Model Development: We developed several AI models to clearly identify the correlation between coil cooling history and rolling load hunting.
4. Optimization and Application: We derived the optimal cooling conditions to minimize material deviation and applied these conditions in actual production sites, achieving a significant reduction in rolling load hunting to about 30% of the previous level.
This study is considered a pioneering attempt by our research team to apply an AI model that connects hot rolling and cold rolling to identify the causes of material deviation in hot rolling.

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