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ADVANCING CONTINUOS CAST SEMI-PRODUCT QUALITY THROUGH A DIGITAL TWIN FRAMEWORK

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The quality of continuously cast steel semi-products (e.g., slabs, billets, and blooms) is fundamental to the efficient production of high-performance steel products for demanding markets. To achieve high casting speeds while maintaining quality, numerous control and monitoring technologies have been successfully developed, even for challenging steel grades.

Recent advancements in phenomena-based modeling, predictive analytics, and deep learning-based quality assessment offer significant potential for enhancing the casting process. Each of these technologies contributes uniquely to process optimization, and their integration into a unified, multi-disciplinary digital framework will enable sophisticated, automated process control.

This paper presents Sapotech's pioneering Digital Twin architecture, which integrates real-time continuous casting process monitoring with Deep Learning-based quality analysis and model-based quality predictions. This approach provides a unique solution that not only delivers numerical and visual feedback on AI-driven quality assessment but also establishes a real-time, interactive visualization of the relationships between process parameters and product quality. At its core, the system incorporates a 3D Digital Twin model of the continuous casting process, combining real-time process data with predictive AI and physics-based modeling. By integrating Sapotech's AI-driven semi-product surface quality assessment within this framework, a fully integrated, online quality feedback loop is achieved, enabling continuous process management, improved defect detection, and enhanced process stability, ultimately ensuring that operations remain within an optimal and acceptable performance window.

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