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Optical Measurement of raw material particle size

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The physical properties of raw material play an important role in the iron and steel making processes. Especially the grain size is important, e.g., for permeability control in the blast furnace or the densification of the sintering process.
However, current grain size measurement methods are often irregular, labor-intensive, and rely heavily on manual effort, limiting the ability to achieve real-time process optimization and potentially leading to inconsistencies in raw material characterization.
This paper presents the development and testing of smart sensors designed to automate raw material grain size measurement using existing optical sensor technologies. Our approach aims to overcome the limitations of traditional methods by providing continuous, automated, and accurate grain size data. This, in turn, enables more precise process control and improved product quality.
We explore and compare two approaches based on optical sensors.
The first approach utilizes a laser line scanner to capture highly accurate height profiles of the raw material as it moves along a conveyor belt. The sensor output is a 3D point cloud that contains the particle shapes.
The second approach employs a camera-based system coupled with advanced image analysis techniques. This method captures two-dimensional images of the material flow, which are then processed to identify and measure individual particles.
We shortly discuss the specific image processing algorithms employed. Afterwards, the approaches are compared in terms of accuracy, speed, and robustness under varying operational conditions. We present experimental results demonstrating the effectiveness of our automated measurement system and discuss its potential for integration into industrial iron and steelmaking environments. Finally, we highlight the advantages and disadvantages of each approach, offering guidance for selecting the most suitable sensor technology based on specific application requirements.

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