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Estimating the amount of Hot Heel in an EAF: a novel, robust approach.

In today's world, Digital Twins are drawing increased attention. Ideally, they are a digital representation of the installation that is used to optimize production and keep the machine in top shape. The steel industry starts adopting this concept, as productivity and availability are key to run a profitable operation.

A digital twin is based on a combination of a digital representation (3D), a set of models mimicking the behavior of the asset, and a stream of data reflecting what the installation is doing at every moment in time. For an EAF, this is not always straightforward. Given the conditions during the process (high temperatures, high electrical currents···), it is not easy to perform direct measurements related to the process. One of the aspects that is critical in running an optimal melting process, is to know the amount of Hot Heel remaining in the vessel. Due to the presence of fumes and slag, a direct level measurement is very difficult or comes with uncertainty. Also, sensors might get damaged during operations. That context resulted in an alternative approach.

The methodology that will be presented is not based on optical or radar principles, but on system dynamics. It relies on the principle that when the EAF vessel has returned to its 0° position, the remaining liquid steel does not instantly stop moving. It will still show a decaying movement: sloshing. This movement can be picked up using a combination of inclinometers and accelerometers located in shielded areas. As the properties of the sloshing: frequency, amplitude and damping ratio, are proportional to the amount of material, the approach uses these properties.

The presentation will provide the context and will show how one can use the dynamic behavior of the EAF vessel to derive the amount of material remaining in the Hot Heel.

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