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Force density in 2D centrifugal system using travelling magnetic field

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Purification of liquid metal from small, unwanted solid particles that are the by-product of industrial processes is a common problem in metallurgy. In practice purification is achieved using various filtration methods such as sedimentation, mechanical filters, etc.

Another used method is centrifugation that uses the rotation of the fluid and inertial forces to separate particles with a density different from that of the fluid itself. Rotation of the liquid metal can be achieved by using a travelling magnetic field, thus inducing separation of the particles. Such a magnetic field can be created by externally rotating magnets, meaning that the system is completely contactless – no moving parts are in contact with the liquid metal at any time, thus also improving overall safety, especially for alkali metals.

The aim of the presented work is to describe and analyse the developed EM force density in a 2D, simplified centrifugal version of such a system using an analytical and numerical approach. The analysis of forces in the system is the first step in calculating the velocity distribution of a centrifugal filter which would, in theory, be able to perform a separation of solid particles from liquid metal.

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