Comsol At Goudsmit Magnetics

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Abstract

Founded in 1959, with headquarters in Aalst-Waalre, the Netherlands, and having approximately 140 employees, Goudsmit Magnetics is a specialist in the field of magnets and magnetism and delivers both standard and custom-made permanent and electro-magnet solutions in various fields, including food, automotive and recycling. Finite-Element-Modelling through Comsol has been extensively used in the past at Goudsmit Magnetics, and is expected to remain a key tool for evaluating both existing products and future innovations.
The main aim of this paper is to present an overview of the state-of-the-art of the Comsol applications at Goudsmit Magnetics, which number is considerably high.
First of all, an overview of the applications in the field of Separation are presented. Here, combined, Multi-Physics, modelling of magnetism (Maxwell's equations - AC/DC), flow (CFD - Fluid Flow) and particle tracing (Newton's second law) is used to estimate the separation performance. Other computed quantities are the magnetic field within the product flow and the pressure drop over the filter. Whereas the FEM Comsol workflow for liquid and gaseous product flows is relatively mature, recent developments are within the field of non-Newtonian fluid modeling, powder flow modelling and modelling of rotating separation equipment. Both these mature workflows and recent developments will be discussed.
Secondly, applications in the application field of Recycling are discussed, which differs from Separation in that material to be recovered has (financial) value to the customer, rather than representing a disturbance to the process - as in Separation applications. Recycling has two components: re-gaining of easily magnetizable materials, like structural steel, and of electrically highly conducting materials through induced Eddy-currents, like aluminum and copper. Most applications here involve stationary - so called - force index computations through the AC/DC toolbox. Recently, the focus has turned on time-dependent modelling of Eddy-current forces on electrically conducting objects moving on a conveyor belt and subject to a rotating magnetic field.
A third set of standard Goudsmit applications involves so called magnetic grippers, which are used to grab and re-locate objects in production lines, like e.g. steel plates. Both standard grippers are discussed but also a recent development called the E-gripper. Here, an electric signal is used to switch the magnetic force on an object on or off. The AC/DC module is particularly used here to compute magnetic forces, in particular as a function of the air gap.
Another group of standard applications at Goudsmit involves Magnet-Hall sensor combinations, which are typically used to detect whether a certain event has occurred or not, like e.g. a dish washer door that is open or closed or a seat belt that is fastened or not. A recent development here is the focus on delivering a robust magnet solution that is guaranteed to work in the presence of manufacturing in-accuracies (tolerances). This can be solved via a relatively brute-force approach using numerous AC/DC type magnetic field computations.
Last but not least, as Goudsmit also regularly encounters non-standard applications, we discuss one of these, i.e. the modeling of a mass spectrometer, which requires AC/DC and particle tracing.

Reference

To be added (paper must still be written)