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COMPRESSION MOLDING PROCESS SIMULATION USING OPENFOAM©

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Abstract. The standard processes available for rubber parts manufacturing are: compression, compression-transfer and injection molding. The selection criteria depends on several factors, namely, the quantity to be produced, the part size, the selected rubber compound, and the available equipment, among others. We aim to analize the manufacturing of curing bladders, used in the tyre industry, using the compression-transfer molding process.
The curing bladder manufacturing process consists of three steps: i) the mold filling, when the green rubber is forced to fill the mold cavity; ii) the in situ curing, when the material is heated until it aquires enought stiffness to be removed from mold; and iii) the post cure, when it is cooled down to room temperature.
The quality of the product depends on the filling process and the degree of cure achieved in the in situ curing step. Due to the nature of the process it is hard to monitor the filling of the mold. Moreover, the experimental determination of the optimal time is usually a difficult and costly task. In this sense, numerical simulation may be of help.
The phenomena to be modeled are: the non-Newtonian behavior of the rubber, the heat transfer process, the curing reaction, and the evolution of the free surface. The model is implemented using OpenFOAM©, an open source CFD software package based on the finite volume method. We present the mathematical model, details on the implementation using OpenFOAM©, and examples using simple geometries.