FRAGMENTATION MODELING OF A RESIN BONDED SAND

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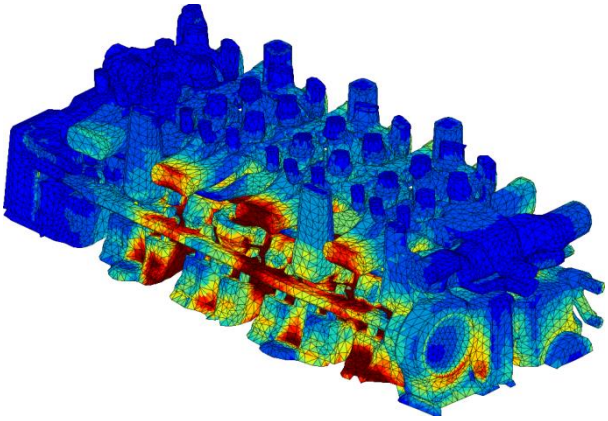

Simplified fragmentation model applied to the sand cores of a cylinder head

- Polyurethane-bonded sand used to mold the internal cavities of cylinder-heads
- Cores removed after solidification of the aluminium with a hammering
- Development of a simplified mechanical model to predict and optimize the cores fragmentation

Abstract:

Polyurethane-bonded cores are used by Montupet in the manufacturing of aluminium to mold the internal cavities of automobile parts like cylinder-heads.
After complete solidification of the part, these cores have to be extracted, as to not leave any residual sand in the part. This decoring operation is most commonly carried out by mechanical vibrations. The objective of the ANR project FIMALIPO (FIssuration de MAtériaux à LIant POlymères) is to develop a complete understanding for the fracture and further fragmentation of sand cores with an experimental analysis and a predictive numerical modeling. The benefits of this project would improve the manufacturing process regarding the reliability and the cost reduction of these complex parts. The experimental study was done in INSA of Lyon with the PhD thesis of Claire Menet. The present work focuses on the modeling and simulation part of the project.
A constitutive elastoplastic model named Cemented Clay and Sand Model was adapted for the thermal ageing of the cores. Then, a new method of model calibration using data pruning, Finite Elements Model Updating (FEMU) and hybrid FEM/Hyper-reduction method was developed. The final aim of the thesis is the validation of a simplified method, focusing on the eigenvalues of the cylinder-head with relevant boundary conditions. It was applied with this constitutive model to predict and optimize the fragmentation of the cores during the hammering.