

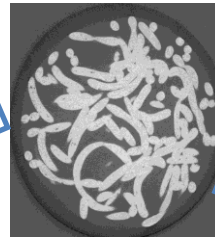
PROJECT DESCRIPTION

LAFARGE - Centre de Recherche
France

Lafarge Center of Research is interested in analysing the microstructure of a fibrous media and its consequence on the resulting macroscopic behavior, for optimization purposes.

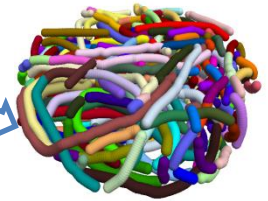


Photograph of a "real" sample



Horizontal section from 3D images after noise reduction

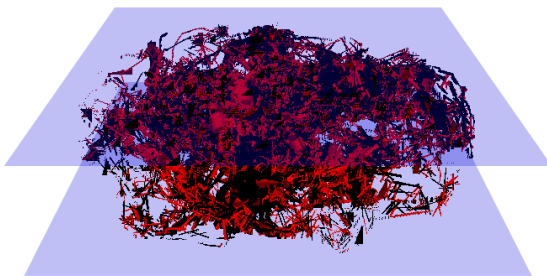
*Fibers modelled in PFC3D
(9000 particles for 427 fibres)*



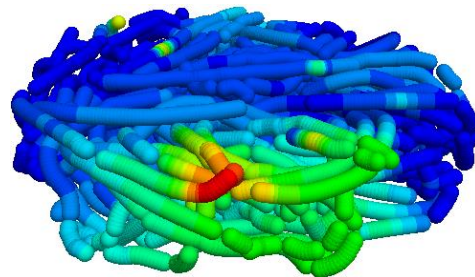
ITASCA'S ROLE

ITASCA built with *PFC3D* a script which precisely models a fibrous structure obtained either from a mathematical algorithm developed by ESIEE, or from a 3D image analysis of a real fibrous sample led by ICMCB. This approach saves the time required to settle the fibers under gravity, numerically time consuming. Needles are modeled as of chains of spherical particles bonded together by a finite-sized piece of cementeous material resisting to both traction and flexion, a "Parallel Bond".

A simple experimental compression test, performed in a micro-tomograph in order to track displacement and failure of each fiber, is used to calibrate the micromechanical properties of the discrete numerical model.



Contact forces (compression in black / traction in red) in a simple compression test



Contour of displacement norm (an horizontal plan defect is visible)

PROJECT RESULTS

- Discrete numerical modelling can precisely model the microstructure of a fibrous media as the 3D analysis (tomography images and fiber segmentation process) allows a good segmentation to be obtained.
- Calibration of the inter- and intra-fiber stiffnesses requires simple compression tests at very small deformation, in the elastic domain.