



Numerical homogenization of hybrid metal foams using the finite cell method

Open-cell aluminum foams represent an important class of core materials that are used to manufacture lightweight sandwich-structured composites. A nickel coating applied by electro-deposition can further improve their properties.

In order to characterize these hybrid metal foams, we perform a full resolution computation of the microstructure. One of the commonly applied methods to obtain the geometry is to use tomographic images. However, the nickel layer shields the aluminum foam such that only a voxel model of the nickel domain is obtained by segmentation of the tomographic data. The aluminum foam needs to be reconstructed in a postprocessing step. Several algorithms known from image processing can directly be applied to the voxel model to build up the aluminum domain inside the nickel layer. Creating a finite element mesh for such a structure implies finding an explicit description of the surface and can be really cumbersome. In order to avoid this problem, we employ the finite cell method (FCM) which is a combination of a fictitious domain method and a high-order finite element method. The FCM can take the geometry into account implicitly during the integration of the stiffness matrix and simplifies the meshing process. A simple Cartesian grid can be automatically generated using the voxel model. Due to the high-order shape functions each element - or cell as referred to in terms of the FCM - can represent a set of voxels. As a consequence, the number of degrees of freedom can be reduced a lot as compared to a voxel finite element simulation. The talk will first summarize the finite cell method and then demonstrate its application to the homogenization of hybrid metal foams.

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[Joint work with Stephan Heinze & Meysam Joulaian]

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DICAr MS1 Meeting Room

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