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# Investigation of mechanical properties of architectured materials

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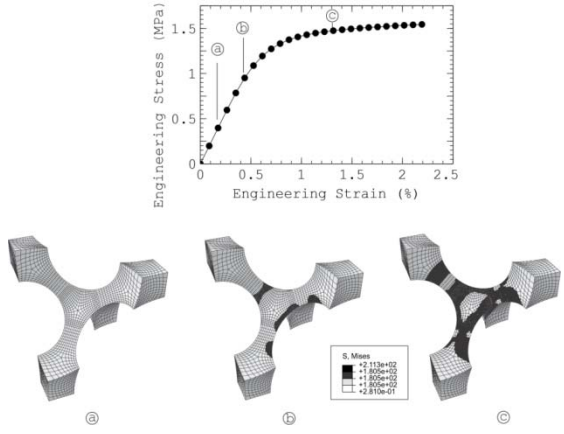
The bottom up approach to make materials which will give desired properties became a major research area in chemistry and physics. The need to estimate / evaluate properties of such "architectured" materials arose in parallel. The engineers can give guidelines to the materials processing industry to produce materials with a certain internal geometry to give desired properties. The engineering mechanics along with homogenization technique is a very powerful tool used for this purpose.

We study various material structures in order to establish their mechanical behaviour under general loading (constitutive laws). Each new material must have its own constitutive relations and failure mechanisms in order for them to be used as a building block in engineering components. A unit cell and finite element model that has been developed for a metallic foam material to estimate its average apparent properties will be presented along with results from the finite element analysis.

It could be seen that the material shows microscopic non-linear behaviour from macroscopic strain less than 1%. The stress continues to increase during the non-linear deformation as well. The stress levels within the unit cell shows that only a narrow band of the ligament will yield even after large macroscopical strain. It has to be verified whether the macroscopical non linearity is due to the geometry of the cell structure, rather than the material yielding. A similar analysis can be done by loading the same unit cell in other directions and shear properties can be estimated.

The average apparent properties of the material can be calculated from this method with less computational cost or actual physical tests.

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