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On the Crushing Response of Open Cell Foams

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The compressive stress-displacement response of foams exhibits a characteristic three regime shape. Initially the response is stiff and linear; this terminates into a limit load followed by an extensive load plateau which governs the foam's energy absorption capacity. Through a combination of experiment and analysis on open cell polymeric foams, it was established that elastic buckling involving interaction of global modes and modes at the cell level are responsible for the stress plateau. The foam is idealized to be periodic using Kelvin cells which are elongated in the rise direction. The ligaments are straight with variable Plateau border cross sections. The initial response, the onset of instability and the initial postbuckling response have been established through characteristic cell type-models discretized with FEs. The localization of deformation, its spreading and the associated stress plateau are reproduced using large scale finite size type models involving a large number of cells.

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