

ENTROPIC FORCES IN THE MECHANICS OF SOLIDS

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Entropic forces in mechanical systems are phenomenological forces that arise from the tendency of the system to maximize its entropy, most commonly without storage of internal energy. The small elastic components that comprise biological structures are typically immersed in water – a thermal environment – in which they are induced to undergo fluctuations. For example, the fluctuations induced in an elastic membrane compete directly against the resistance of the membrane to bending. This competition is statistical rather than deterministic and, to render it quantitative, it is considered within the framework of classical statistical mechanics. The means of estimating the constraining forces which are generated in such systems is the central point of the discussion. A number of simple examples are analyzed to illustrate the main ideas involved, and the presentation concludes with a discussion of confinement of a fluctuating elastic membrane within a stack of identical and nominally parallel membranes, giving rise to an entropic mutual repulsion.

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