On the Existence of Minimizers with Prescribed Singular Points in Nonlinear Elasticity

Jeyabal Sivaloganathan
Department of Mathematical Sciences
University of Bath
Bath BA2 7AY,
U.K.

and

Scott J. Spector
Department of Mathematics
Southern Illinois University
Carbondale, IL 62901-4408,
U.S.A.

Abstract. Experiments on elastomers have shown that sufficiently large triaxial tensions induce the material to exhibit holes that were not previously evident. In this paper conditions are presented that allow one to use the direct method of the calculus of variations to deduce the existence of hole creating deformations that are global minimizers of a nonlinear, purely elastic energy. The crucial physical assumption used is that there are a finite (possibly large) number of material points in the undeformed body that constitute the only points at which cavities can form. Each such point can be viewed as a preexisting flaw or an infinitesimal microvoid in the material.

Mathematics Subject Classifications (2000): 74G65, 74G70, 74B20, 49J40, 35J50.

Key words: Cavitation, degree, distribution, elastic, elastomer, elastostatics, equilibrium, finite, fracture, injective, Jacobian, microvoid, minimizer, nonlinear, one-to-one, polyconvexity, singular, solid.