Nonlinear elasticity for modeling fracture of soft materials

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The non-linear theory of elasticity can be used for modeling crack nucleation and propagation. In this way fracture – cracks – appear as a result of the solution of a clearly formulated initial-boundary-value problem rather than a vague combination of the ad-hoc "conditions" and "rules".

Two physical observations – the bounded bond energy and diffused bond breakage – allow formulating a consistent theory of failure and fracture without introducing internal variables.

We discuss a simple mathematical formulation of the theory and show results of numerical simulations of crack nucleation and propagation in soft materials.

There is no doubt that the nonlinear theory of elasticity and, more generally, the nonlinear continuum mechanics are powerful enough to describe fracture directly – "from the first principles".

References

[1] Volokh KY (2017) Fracture as a material sink, Materials Theory 1:3
[2] Faye A, Lev Y, Volokh KY (2019) The effect of local inertia around the crack-tip in dynamic fracture of soft materials, Mech Soft Mater 1:4
[3] Abu-Qbeitah S, Jabareen M, Volokh KY (2023) Quasi-static crack propagation in soft materials using the material-sink theory, Int J Mech Sci 248:108160
[4] Abu-Qbeitah S, Jabareen M, Volokh KY (2022) Dynamic Versus Quasi-Static Analysis of Crack Propagation in Soft Materials, J Appl Mech 89: 121008
[5] Abu-Qbeitah S, Jabareen M, Volokh KY (2023) Modeling cracks in viscoelastic materials at finite strains, submitted
[6] Abu-Qbeitah S, Jabareen M, Volokh KY (2023) On strength and fracture toughness of soft composites, submitted