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An Asymptotic Analysis of Mode I Crack in Creepnig Damaged Solids

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To evaluate the mechanical behaviour around a Mode I crack tip the governing equations are formulated by light of Continuum Damage Mechanics. The asymptotic stress and continuity fields near the tip of a stationary crack are derived for non-linear viscous damaged materials, which deform according to the creep power constitutive law. The conventional Kachanov–Rabotnov creep-damage theory is utilized and the scalar continuity parameter is incorporated into the constitutive relations. Thus, the coupled system of damage mechanics – creep theory equations is considered. Based on the similarity variable a stress analysis is carried out for Mode I crack under plane stress and plane strain conditions assuming the existence of a totally damaged zone near the crack tip. It is found that the Hutchinson-Rice-Rosengren solution can't be used as the remote boundary condition and the actual far field stress is obtained. The shape of the totally damaged zone is given and analysed.

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