# SIMULATION OF CRACK PROPAGATION DUE TO BRITTLE AND DUCTILE FAILURE IN A MICROPOROUS THERMOELASTOVISCOPLASTIC PRENOTCHED PLATE

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We analyze plane strain deformations of a rectangular plate with two parallel notches placed symmetrically about the horizontal centroidal axis of the plate. The plate is struck by a cylindrical projectile of diameter equal to the distance between the notches and made of the same material as the plate. The plate material is modeled as heat conducting microporous elastoviscoplastic. Hardening of the material due to strain and strain-rate effects and its softening due to heating and porosity evolution are accounted for. Except for the impacted face, boundaries of the plate are thermally insulated and traction free. At the smooth impacted surface, the action of the projectile is simulated by prescribing the normal component of velocity as a function of time and setting the normal component of heat flux equal to zero. The initial-boundary-value problem is solved by the finite element method. A crack due to brittle failure is assumed to initiate from a point when the maximum principal tensile stress there equals 2.34 times the quasistatic yield stress of the material. A crack due to ductile failure initiates at a point when the effective plastic strain there equals 0.5. For the 4340 steel, it is found the failure mode transitions from brittle to ductile at an impact speed of about 21 m/s. The effect of crack propagation on the ensuing deformations is delineated.