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Analysis of Problems in Generalized Viscoplasticity under Dynamic Thermal Loading

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Abstract: This paper examines two uncoupled quasistatic problems for thermo-viscoplastic materials, wherein the equation model considers the dependence of mechanical properties on a parameter θ, which represents the absolute temperature. Specifically, both the tensor of viscosity and the plastic deformation depend on this parameter. The boundary conditions for these problems are displacement traction and Signorini conditions. Our analysis establishes the existence of a unique solution to the problems, as well as the continuous dependence of the solution on the parameter θ. To provide a practical demonstration of our findings, we also present two one-dimensional examples that describe the processes involved in these problems.

Keywords: *viscoplastic; temperature; variational equality; Cauchy-Lipschitz method.*

Mathematics Subject Classification (2010): 35D30, 70K75, 74F05, 74M15, 74F05, 74C10, 93A30.

1 Introduction

Our study focuses on the analysis of two models designed for thermo-viscoplastic materials, which exhibit a unique coupling between their mechanical and thermal properties. Over the years, mathematicians, physicists, and engineers have extensively studied thermo-viscoplasticity laws to effectively model the influence of temperature on the behavior of various materials such as metals, magmas, and polymers. To gain further insight, we refer the interested readers to the sources such as [1, 2, 4, 5, 8, 11, 15]. Moreover, practical applications and mechanical interpretations of thermo-viscoplasticity can

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