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Avalanche Initiation in Layered Snowpacks: Application of Quantized Fracture Mechanics in the Presence of Friction

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Extended Abstract

Abstract

Spontaneous avalanche releases, potentially further influenced by the indirect global warming effects, pose a serious natural hazard toward the safety of the mountain community as well as causing extensive property damages. Ever since the first fracture mechanics study of avalanches by McClung [1], a great effort has been directed toward understanding the failure processes that lead to avalanche release. In this work, we apply the theory of Quantized Fracture Mechanics (QFM) [2] for predicting avalanche initiation as a process of crack propagation in layered snowpacks accounting for interlayer friction in addition to fracture. The snow slab is represented as an elastic beam with a layer-wise distribution of elastic modulus and density supported by an elastic foundation which represents the weak layer [3,4]. The effect of interlayer friction on the stress transfer to the weak layer is considered in the presence of mode II [1] as well as mode I anti-crack [5]. Previous QFM predictions under mode II and friction [6] are extended to include the effect of mode I anti-crack in the presence of slab bending effects. Stress redistribution within the snowpack as a result of interfacial crack growth is also examined and the conditions leading to subsequent fracture within the slab are presented. Application of the QFM allows us to examine potential size effects on fracture behavior both along the interface and within the layered snow slab [2,7]. References [1] D. M. McClung, “Shear fracture precipitated by strain softening as a mechanism of dry slab avalanche release,” J.

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Keywords:

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