Analysis and Modeling of Snap Loads on Synthetic Fiber Ropes

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(ABSTRACT)

When a rope quickly transfers from a slack state to a taut state, a snapping action occurs and produces a large tensile force which is known as a snap load. Energy is dissipated during this snap load, and it is proposed to use synthetic fiber ropes as a type of passive earthquake damper in order to take advantage of this phenomenon. This thesis is the second phase of a multi-stage research project whose goal is to investigate and develop what will be known as Snapping-Cable Energy Dissipators (SCEDs).

The experimental data that was collected in the Master's Thesis of Nicholas Pearson was organized and analyzed as a part of this research in order to evaluate the behavior of the ropes during the snapping action. Additional tests were also conducted for this project under more controlled conditions in order to better understand how the ropes change throughout a sequence of similar snap loadings and also to determine the amount of energy that is dissipated. The data from both projects was then used as input parameters for a mathematical model that was developed to characterize the behavior of the ropes during a snap load. This model will be utilized in subsequent research involving the finite element analysis of the seismic response of structural frames containing SCEDs.