

# **Experimental Snap Loading of Synthetic Fiber Ropes**

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(ABSTRACT)

Energy is lost when a rope transfers from a slack state to a taut state. This transfer is called a snap load and can be very violent. It is proposed to use synthetic fiber ropes as a type of passive control device in new or existing structures to mitigate seismic response. Experimental static and snap load (dynamic) tests were conducted on various synthetic fiber ropes. An eleven-foot-tall drop tower was built in the Virginia Tech Structures and Materials Laboratory in order to conduct these tests.

Force and acceleration of the drop plate, which slides vertically within the drop tower, were measured with respect to time for all dynamic tests. Acceleration data was integrated using the trapezoidal or midpoint rule to obtain velocity and displacement values. Plots were made for each test in order to give a better representation of the results. These plots include representations of force and acceleration vs. time, force vs. absolute displacement, force vs. velocity, and force, acceleration, velocity, and displacement vs. time (during the initial taut phase only).

Test results show that energy was dissipated in all of the dynamic drop tests, which was expected. Also, the displacement of each rope did not return to zero at the same time that the force returned to zero after the initial snap load. This proves that the ropes undergo some permanent elongation under load. The stiffness of each rope increased with continuous testing. As more tests are conducted on each rope, the strands are pulled tighter into the braided configuration, which causes the rope to become stiffer.

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