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Snow avalanche vortex shedding induced vibrations

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It is known that structures shed vortices under the action of subsonic flows. As the vortices are first shed from one side of the structure and then from the other, different surface field pressures are created around the structure. The pressure oscillations cause elastic structures to vibrate. The vibration induced in a cylindrical structure by vortex shedding of an avalanche flow is addressed in this work. The vibration modes induced in the structure can provide information on the velocity of the flow moving around a structure.

In this study we take advantage of the availability of the data recorded by a geophone (GF1) fixed within a 6 m high cylindrical structure installed at Ryggfonn, the NGI avalanche experimental site in Norway. The released avalanches on this way down the slope, first impacts the steel tower structure and then continues flowing around it farther down. As a consequence, a vortex street is created around the cylinder producing vibrations on the structure.

Modal analysis of the data recorded at GF1 through the Empirical Mode Decomposition and Hilbert Huang Spectra techniques were performed to obtain the evolution of the dominant frequencies of vibration of the steel tower. Although the results are still preliminary, main vortex shedding frequencies and the subsequent flow velocities for different avalanches could be identified. As a result, we can get a continuous velocity evolution of an avalanche flow at a given point (i.e. steel tower).

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