



Dynamic triggering and synchronization: laboratory and field scale

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Synchronization and triggering of dynamic events by weak external forcing is ubiquitous and is observed in biological systems, lasers, electronic networks etc. In the present report new experimental data on the phase synchronization in spring-slider system induced by a weak mechanical or electromagnetic periodic forcing are analyzed. Modern tools of nonlinear dynamics are used for quantitative analysis of stick-slip time series, exactly, of acoustic emissions (AE), which accompany slip displacements. The intensity of forcing needed for synchronization is very low and this can explain the recently discovered effect of remote dynamic triggering and synchronization of remote seismic activity by strong earthquakes.

Experimental discovery of effect of high order synchronization (HOS) by weak electromagnetic or mechanical periodic forcing is a new result in the stick-slip research. We found that not only the onsets/maxima of AE signals are synchronized with forcing, but also AE wave train terminations. Two kinds of HOS are found: i. one or more AE bursts generated in one forcing period and ii. one AE burst during many forcing periods.

It was found that the onset times of the synchronized slip events delay behind the forcing phase; the delay is smaller for stronger forcing.

The results obtained can be very useful for refining the physical mechanism of frictional motion in general and can also help to find new regularities in seismic time series.