

Phase synchronization of slips by periodical (tangential and normal) mechanical forcing in the spring-slider model

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A b s t r a c t

In the present study, the character of slip regimes under weak external periodical (tangential and normal) mechanical forcing has been investigated in a laboratory spring-slider system. We report the experimental evidence of phase synchronization in a slip dynamics, induced by the external periodic mechanical impact. At certain conditions, we have a stick-slip effect in the spring-slider system. To describe this effect, we can use rate- and state-dependent friction law.

In our experiments, the slip events are distinguished by acoustic emission bursts, which are generated by slider displacement. In addition to drag, the weak variable mechanical forcing was superimposed either tangential or normal to the slip plane. With increasing external forcing one can see increasing phase synchronization of the first arrivals (onsets) of stick-slip generated acoustic pulses. The grouping of the onsets in a certain phase of the external periodic forcing is considered as a hallmark of the phase synchronization. The onsets of stick-slip pulses in the case of normal mechanical forcing are shifted relative to onsets in the case of tangential forcing.

Key words: stick-slip, phase synchronization, periodical mechanical forcing.