Synchronization of stick-slip acoustic emission caused by small influences
Teimuraz N. Matcharashvili, Tamaz L. Chelidze, Natasha N. Zhukova, Eketerine V. Mepharidze
M. Nodia Institute of Geophysics, Tbilisi, Georgia
matcharashvili@gtu.ge

We investigated dynamics of acoustic emission, accompanying stick-slip motion of sample rocks and influence of small external impacts on its features. For that, laboratory spring-slider system has been developed enabling registration of acoustic emission (AE) related to stick-slip at different sliding regime and relative external forcing. Series of time intervals between consecutive waveforms of AE and its maximums have been analyzed. To create these time series, experimental recordings were conditioned, wave trains separated and onsets of the AE detected. For quantitative evaluation of changes in dynamics of acoustic wave generation, nonlinear recurrence quantitative analysis (RQA) and phase synchronization testing procedures have been used. Analysis was carried out for three sliding regimes as well as weak normal forcing up to 30 % relative to applied dragging force. It was shown, that extent of deterministic structure in dynamics of acoustic wave generation depends on movement regime. Moreover, external forcing up to 25% relative to dragging force may synchronize phase of stick-slip motion, what leads to increase of extent of order in dynamics of AE.

Keywords: Synchronization, Stick-slip, Acoustic emission, Nonlinear dynamics, Recurrent analysis.