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Non-conventional synchronization in the chains of weakly coupled nonlinear autogenerators

Margarita Kovaleva, Leonid Manevitch

Abstract: The phenomenon of synchronization in the system of two autogenerators was first observed by Huygens. It was a stationary synchronization, or in modern terminology the synchronization on Nonlinear Normal Mode (NNM). Synchronization of this type (conventional synchronization) was intensively studied, especially during last decades. We have revealed an alternative, non-conventional synchronization or synchronization on the Limiting Phase trajectory, which corresponds to beatings as attractor[2,3]. To prove the existence of LPT-synchronization we used the group Lie theory which allowed to find additional symmetry (to the temporal shift) and a corresponding integral of motion. It was shown numerically that one can obscure the LPT synchronization even out of the symmetry conditions. We propose now a new topological criterion of LPT synchronization existence in nonlinear chains of self-sustained oscillators. It is based on the analysis of the stationary states stability in the slow time-scale. Absence of the stationary attractors provides existence of LPT synchronization. The discussed method does not require closeness of the amplitudes of the oscillators, while such limit is supposed in the Kuramoto approximation. Authors are thankful to the Program of Fundamental Researchers of the Russian State Academies of Sciences 2013-2020 (project No. 0082-2014-0013) for financial support

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[1)] Margarita Kovaleva, Professor: Semenov Instute of Chemichal Physics Russian Academy of Sciences, Moscow 119991 Kosygin st,4, Russia (RU), margo.kovaleva@gmail.com, the author presented this contribution at the conference in the special session "Synchronization and nonlinear normal modes in physics and structural dynamics" organized by M. Kovaleva, L. Manevitch and V. Pilipchuk.

[2)] Leonid Manevitch, Professor: Semenov Instute of Chemichal Physics Russian Academy of Sciences, 119991 Moscow, Kosygin st, 4, Russia (RU), manevitchleonid3@gmail.com.