Canard Mediated (De)Synchronization in Coupled Phantom Bursters

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Résumé

Collective dynamics of coupled slow-fast oscillators have a great importance in the context of physiology when microscopic and macroscopic levels can be represented as relaxation oscillators. Synchronization of multiple timescale systems may involve synchrony of fast timescale dynamics, spikes, and/or slow timescale dynamics. In this presentation, we focus on the effect of canards on collective dynamics of an extended version of a neuroendocrine model which accounts for the alternating pulse and surge pattern of gonadotropin releasing hormone secretion. The model is formed by two FitzHugh-Nagumo oscillators that evolve on different timescales, with a feedforward coupling from the slow one (regulator) to the fast one (secretor). Global and local features of the resulting 4D three timescale model have been studied in the context of slow-fast dynamics and MMOs where folded singularities and associated canard trajectories have a particular importance. For instance, so-called secondary canards due to a folded node are responsible for the presence of a plateau with small oscillations in the model output, after the surge and before the pulsatility resumption. We extend the model to 6D by adding one more secretor and focus on the slow-fast transitions in the presence of coupling. We explore the influence of the relationship between canard structures and coupling on patterns of synchronization and desynchronization. We propose two different sources of desynchronization, induced by canards near a folded node and canards near a folded saddle, respectively.

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