Bumps in a two - population neuronal field model

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Abstract

We review the properties of a two population neuronal field model of the Wilson - Cowan type investigated in Blomquist et al [1] and Wyller et al [2]. The model is characterized by different firing threshold values for the excitatory and the inhibitory population. The first part of the talk will be devoted to the study of the existence and stability of bumps in the Heaviside limit of the firing rate functions [1]. It turns out that the generic picture consists of two pulse pairs for each set of threshold values, a "narrow" one and a "broad one". The narrow one turns out to be unstable for all relative inhibition times, while the broad one is stable for small and moderate values of the relative inhibition times and is converted to a breather due to a Hopf - type of bifurcation as the relative inhibition time exceeds a certain threshold. The second part of the talk will deal with pattern formation due to a Turing type of instability mechanism [2]. It is demonstrated that for steep firing rate functions we get patterns consisting of spatial oscillations which looks similar to the bumps obtained in the Heaviside limit, while the shallow firing rate regime produces spatio - temporal oscillations. The final part of the talk is devoted to some preliminary results regarding the stability of bumps when the temporal kernels of the network are modeled by means of α - functions.

Keywords: Neural field models; existence and stability of bumps; pattern formation

References

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[2] J. Wyller, P. Blomquist and G.T. Einevoll, Turing instability and pattern formation in a two-population neuronal network, Physica D, 225,75–93(2007). (http://arken.umb.no/∼gautei/forskning/wyller-2007.pdf)