Status meeting October 29, 2020
Msc Thesis - Dynamics of adaptive neuronal networks.
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1 Writing out the whole system

When we assemble the whole expression for the Ott-Antonsen manifold as found in [1] we obtain the following:

$$\frac{\partial z(\boldsymbol{k},t)}{\partial t} = -\mathrm{i}\frac{(z(\boldsymbol{k},t)-1)^2}{2} + \frac{(z(\boldsymbol{k},t)+1)^2}{2}\cdot I(\boldsymbol{k}) \tag{1}$$

$$I(\boldsymbol{k}) = -\Delta(\boldsymbol{k}) + \mathrm{i}\eta_0(\boldsymbol{k}) + id_n\kappa\cdot H_n(\boldsymbol{k},t) \tag{2}$$

$$H_n(\boldsymbol{k},t) = \frac{a_n}{\langle k\rangle}\sum_{\boldsymbol{k'}} P\left(\boldsymbol{k'}\right) a\left(\boldsymbol{k'}\to\boldsymbol{k}\right)\cdot\left[A_0 + \sum_{p=1}^{n} A_p\left(z\left(\boldsymbol{k'},t\right)^p + \bar{z}\left(\boldsymbol{k'},t\right)^p\right)\right] \tag{3}$$

Following [2], $H_2(\boldsymbol{k},t)$ is computed as:

$$H_n(\boldsymbol{k},t) = \frac{a_n}{\langle k\rangle}\sum_{\boldsymbol{k'}} P\left(\boldsymbol{k'}\right) a\left(\boldsymbol{k'}\to\boldsymbol{k}\right)\cdot\left(1 + \frac{z(\boldsymbol{k'},t)^2 + \bar{z}(\boldsymbol{k'},t)}{6} - \frac{4}{3}\mathrm{Re}(z(\boldsymbol{k'},t))\right) \tag{4}$$

2 Fixpoint iteration

3 A Newton-Raphson

References

[1] S. Chandra, D. Hathcock, K. Crain, T. Antonsen, M. Girvan, and E. Ott, *Modeling the Network Dynamics of Pulse-Coupled Neurons.* *Chaos (Woodbury, N.Y.)* **27** (03, 2017) 10.

[2] C. Bick, M. Goodfellow, C. Laing, and E. Martens, *Understanding the dynamics of biological and neural oscillator networks through exact mean-field reductions: a review.* *Journal of Mathematical Neuroscience* **10** no. 1, (Dec., 2020) .