

Spatially structured oscillations in a two-dimensional excitatory neuronal network with synaptic depression

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Abstract

Abstract text describing the study of spatially structured oscillations in a two-dimensional excitatory neuronal network with synaptic depression. The text discusses the model, the results of the analysis, and the implications for understanding neural oscillations in the brain.

Keywords

Keywords: Spatially structured oscillations, synaptic depression, neuronal network, two-dimensional, excitatory, oscillations.

1 Introduction

1 Introduction text discussing the background of the study, the motivation for the work, and the goals of the paper. It mentions the *in vivo* and *in vitro* contexts and the specific parameters of the model.

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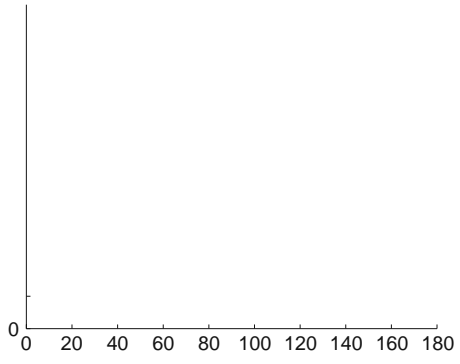
$$\mathbf{f}_i \cdot \mathbf{u} = \mathbf{H}_i \mathbf{u} - \dots = \dots \cdot \mathbf{u} \quad (.)$$

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$$\mathbf{f}_i \cdot \mathbf{r} = \dots$$

$$\left(\begin{array}{c} \mathbf{u} \\ \mathbf{v} \end{array} \right) + \left(\begin{array}{c} \mathbf{r} \\ \mathbf{f} \end{array} \right) = \left(\begin{array}{c} \mathbf{t} \\ \mathbf{t} \end{array} \right) \quad (1)$$



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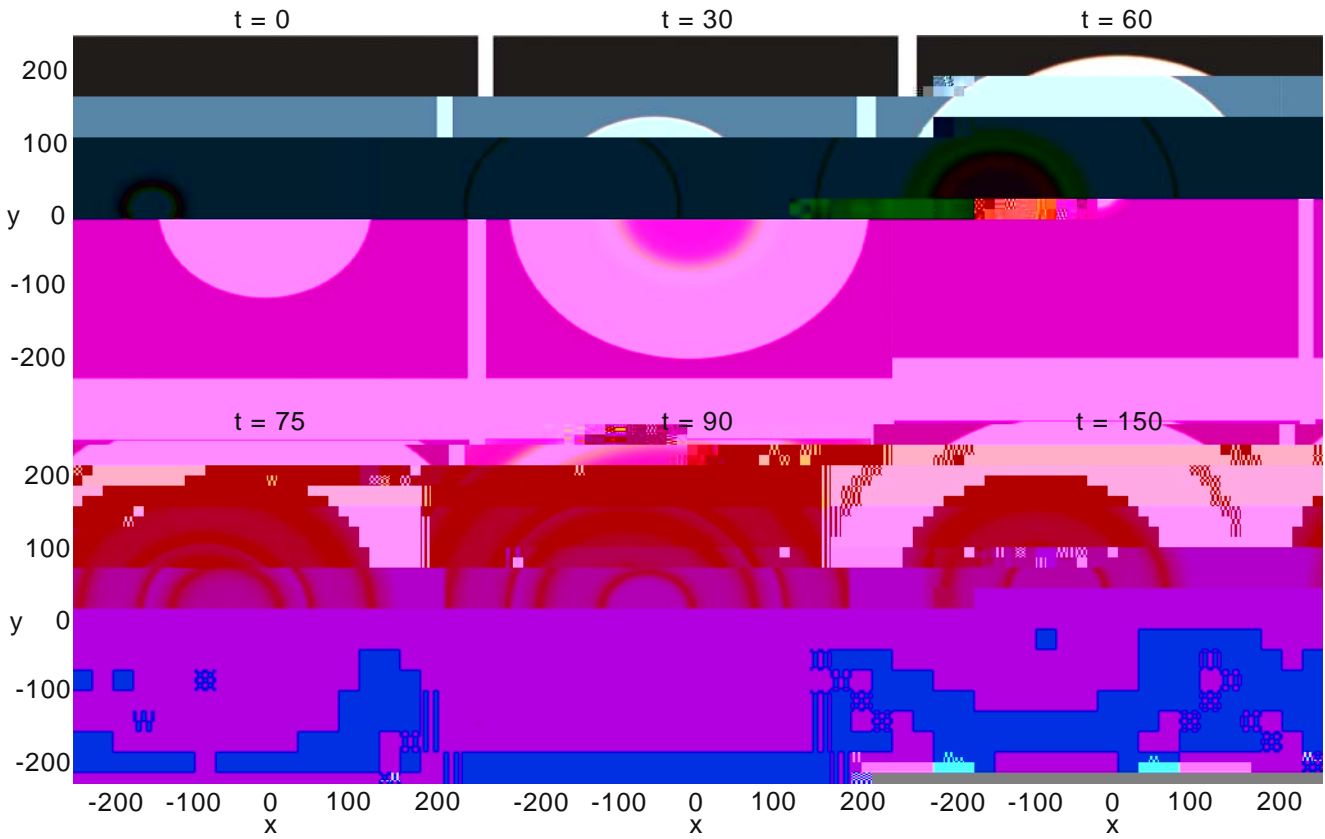


Fig. 7 Simulation of the evolution of the system $u(x,y,t)$ for different times t . The plots show the spatial distribution of the variable u at various time steps: $t=0, 30, 60, 75, 90, 150$. The x and y axes range from -200 to 200. The color scale represents the value of u , ranging from dark blue (low values) to dark red (high values).

$(0,0)$. The simulation shows the evolution of the system over time. At $t=0$, the system is in a state of rest. As time progresses, a wave packet moves from left to right across the domain. The wave packet consists of a pulse followed by a series of oscillations. The amplitude of the oscillations increases as the wave packet moves. At $t=150$, the wave packet has reached the right boundary of the domain and is reflecting back. The overall behavior is characteristic of a dispersive wave in a medium with a varying refractive index.

The simulation results are shown in Fig. 7. The plots illustrate the spatial distribution of the variable u at different time steps. The wave packet is clearly visible as it moves across the domain. The color scale indicates the magnitude of u , with red representing high values and blue representing low values. The wave packet's leading edge is sharp, while the trailing edge is more diffuse. The oscillations within the wave packet become more pronounced as time increases. The simulation demonstrates the complex interaction between the wave and the medium's properties.

$$L_h \frac{u_{ij}^{k+} - u_{ij}^k}{t} + u_{ij}^{k+} = M q_{ij} f, u_{ij} \quad (.1)$$

$$L_h \frac{q_{ij}^{k+} - q_{ij}^k}{t} = - q_{ij} f, u_{ij} \quad (.)$$

$i = 1, \dots, N_x, j = 1, \dots, N_y, L_h \neq t$
 $u_{ij} = q_{ij} f, u_{ij} \quad (.1),$
 $u_{ij} = q_{ij} f, u_{ij} \quad (.1),$

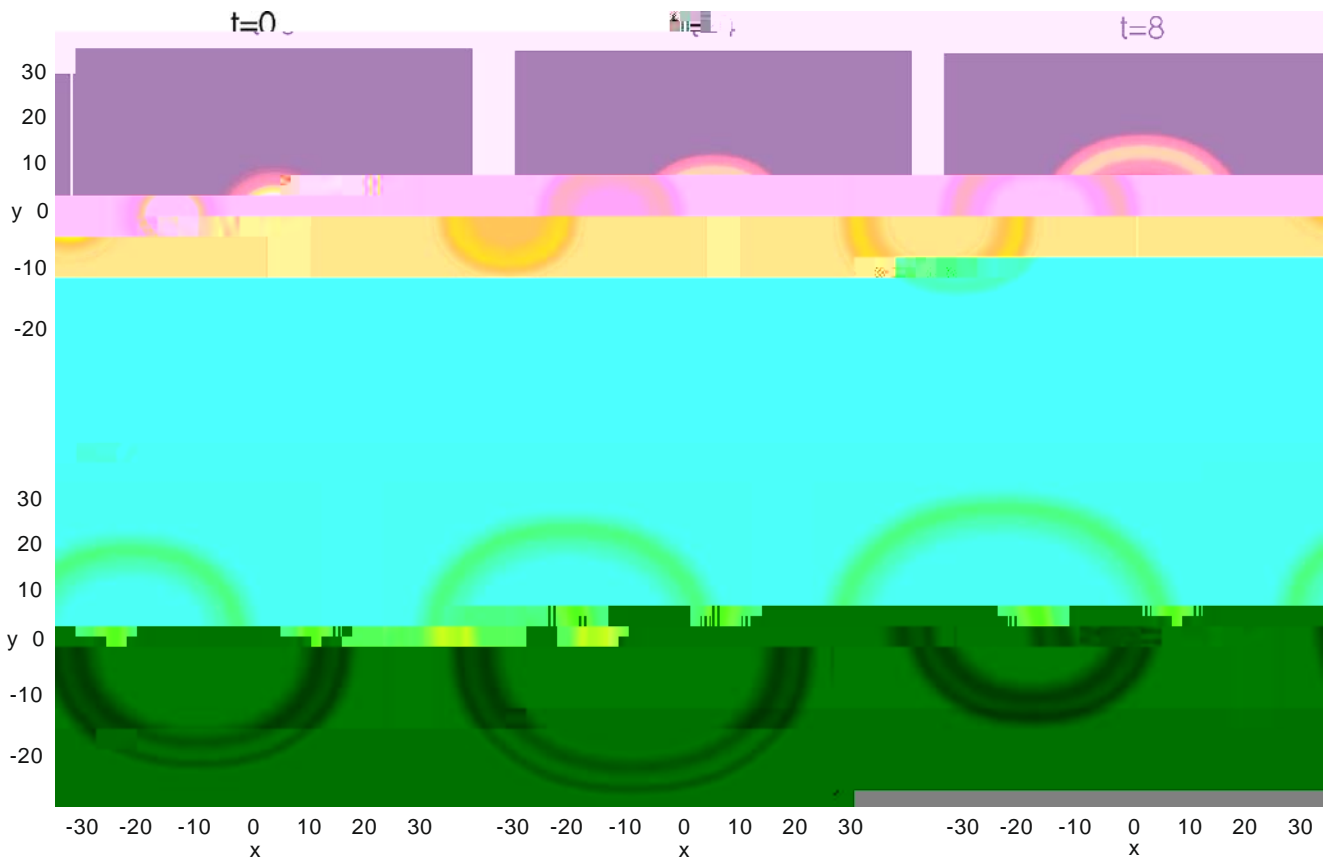


Fig. 13 S_i $r_{i,j}$ $t_{i,j}$ $u(x,y)$

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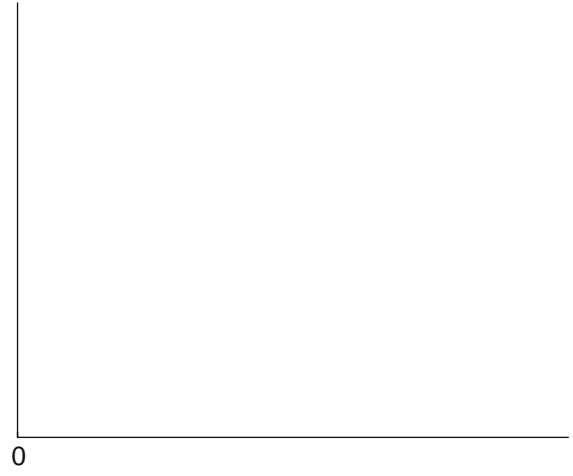
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Acknowledgements

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