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A study on optical control of neurons and its dynamics

Abstract:

Recent researches have shown that controlling neurons with photons helps to understand the functioning of brain and to treat associated diseases.In the proposed work an appropriate photosensitive neuron model is used to estimate the nonlinear encoding and responses of neurons driven by external optical signals. Here Phototube can capture and transmit external illumination with high frequency which can fed into the nonlinear circuit. The effect of photocell can be excited by the photocurrent generated from the photocell. This can be tamed to produce the different dynamical properties of biological neurons. Hence the involvement of functional electronic components can enhance the biophysical function of artificial neural circuits. The coupling possibilies light-dependent neural circuits under a nanoscale memristive component and different noise induced collective dynamics of photosensitive neurons under small-world network etc. are also focused on study. The work also addresses how chaos in neural systems accomplishes biologically important goals such as synchronization, anti synchronization and oscillation quenching mechanism etc.Bifurcation plot,Lyapunov exponent,Hamilton energy and stability analysis etc. are carried out to examine neuronal response. So in the present study,where light is used as control system to understand how the brain works and to create new tools to treat diseases. It may possible to tune neuron excitability up and down in a light controllable neuron . So changes in neuronal excitability affect neuronal disorders which in turn can control diseases such as Epilepsy, Alzhemeres etc.

Biography

Sunsu Kurian Thottil currently employed as the Chief Minister's Post-Doctoral Fellow at Government College, Nattakam,Kottayam India.She received PhD from M.G. University (2021)at age of 35 and have authored international papers, participated in conferences, and contributed to book chapters. Also earned M.Phil.Physics degree from CUSAT in 2011. She have been a lecturer for five years, with teaching experience both PG and UG students. Her research interests are in nonlinear dynamics and focused on theoretical work based on neural network.