

Noise induced resonance effects in UJT relaxation oscillator

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In this poster, the constructive role of noise, which is generally termed as coherence resonance (CR) has been studied in the threshold based system. The basic characteristic of such system is that it shows fixed point and limit cycle attractors below and above the threshold respectively. When the system resides at fixed point, it reacts to an external perturbations in two different ways depending upon the perturbation amplitude and when the amplitude is small to cross the threshold, the system remains at stable state and if large enough to cross, produces a large amplitude excursion in the output through limit cycle before settling back to the fixed point. Application of the time dependent external stochastic perturbation produces coherent limit cycle oscillations depending upon the amplitude of the perturbation and maximum coherency has been observed for the optimum noise and coherency decreases for higher noise level.

The experiment has been carried out in an UJT relaxation oscillator (UJT-ROs) whose schematic circuit diagram has been shown in Figure 1. For the present experiments, the emitter (E) voltage (V_E) was modulated with the noise and the output was recorded at two points E (V_{E0}) and B1 (V_{B10}) respectively.

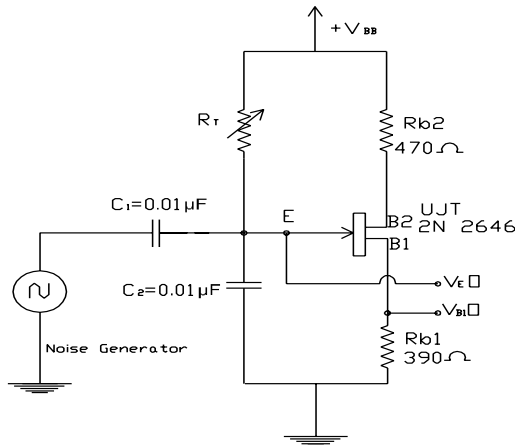


Figure 1: Circuit Description of the UJT Relaxation Oscillator

Figures 2(a)–2(c) (left panel) show the time series of the output recorded at output V_{E0} of the oscillator for different noise levels and Fig. 2 (d) is the experimental NV curve as a function of noise amplitude D. The appearance of minimum in NV curve 2(d) indicates CR.

Figures 2(a)–2(c) (left panel) show the time series of the output recorded at output V_{E0} of the oscillator for different noise levels and Fig. 2 (d) is the experimental NV curve as a function of noise amplitude D.

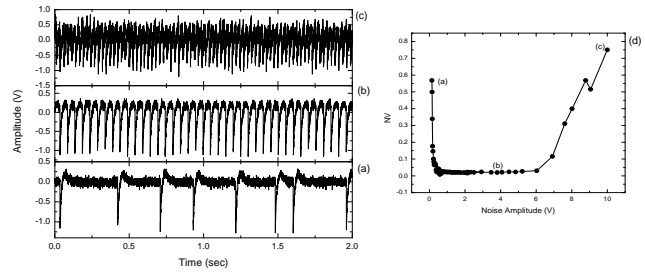


Figure 2: Emergence of coherence resonance for the output recorded at emitter (V_{E0}): The right panel shows the NV as a function of noise amplitude for the experiments performed at $V_E = 3.142V$. Left panel: The time series of the output for (a) low, (b) optimum and (c) high-level noise.

tion of noise amplitude D. It shows that the appearance of the minimum in the NV curve is not always necessary for CR.

Direct modulation of the strong noise distorts the limit cycles particularly its peaks and as the excursion time is almost independent of noise amplitude, the increase in NV in Fig 2(d) at higher noise comes from the increase in the variation of the inter-peak distances of the distorted limit cycle at high level of noise but that does not happen in the later case [Fig 3(d)]. In this case, the noise is blocked by UJT to be transmitted to the other side.

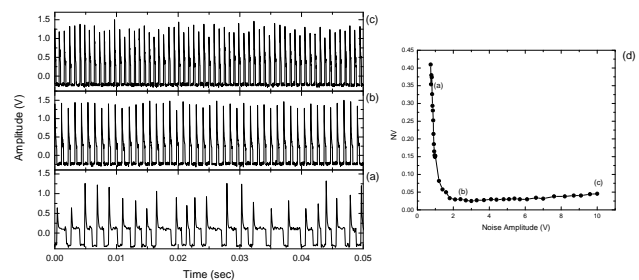


Figure 3: Emergence of coherence resonance for the output recorded at base1 (V_{B10}): The right panel shows the NV as a function of noise amplitude for the experiments performed at $V_E = 3.142V$. Left panel: The time series of the output for (a) low, (b) optimum and (c) high-level noise.

In conclusion, the effect of noise has been studied experimentally in UJT-ROs. We have also shown that depending upon system properties, coherency may or may not be significantly destroyed at high amplitude noise.

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