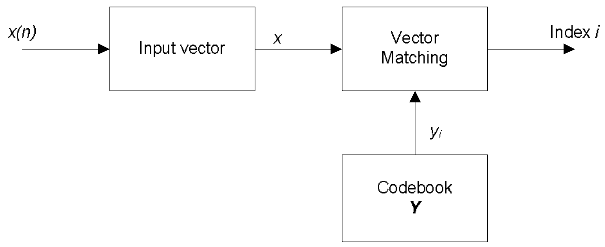

Figure 2. Block diagram of simple vector quantizer.

The collection of vectors y – a codebook – is obtained with the help of special algorithm named k-means.

VQ allows exploiting dependencies among vector components. This fact is rather a big advantage over the scalar quantization.

VQ algorithms are divided into several subtypes. The main of them are: multistage VQ (MSVQ) and variable dimension vector quantization (VDVQ). VDVQ has become very popular recently because of its ability to work with input vectors with different length and this fact improves the efficiency of quantization.

The quantization is a very powerful tool for signal compression tasks. It can reduce data amount with rather small quality loss. The main problem of this tool utilization is to choose which type of algorithm is needed for specific information.

Bibliography:

1. Kondoz A.M., Digital Speech – Coding for Low Bit Rate Communication Systems, NY.:John Wiley and Sons Ltd, 2004, pp.26-28, 39-54.
2. Chu W.C., Speech Coding Algorithms – Foundation and Evolution of Standardize Coders, NY.:John Wiley and Sons Ltd, 2003, pp.143-158, 184-194.
3. Das A., Rao A., Gersho A., Variable-Dimension Vector Quantization, IEEE Signal Processing Letters, vol.3 No.7, July 1996, pp.200-202
4. Chu W.C., A Novel Approach to Variable Dimension Vector Quantization of Harmonic Magnitudes, Proc 3rd IEEE International Symposium on Image and Signal Processing and Analysis, vol.1, Rome, Italy, September 2003, pp.537-542.

CARBON NANOTUBE BASED DETECTOR OF MODULATED TERAHERZ RADIATION

Belarusian State University of Informatics and Radioelectronics
The Republic of Belarus, Minsk

Anton Yermalovich

Liahushevich S.I. − Associate Professor

Due to recent success in development and visualization of nanosized clusters and other metallic nanoparticles, a newbranch of nanooptics and nanotechnology quickly develops — nanoplasmonics. The most important feature of nanoplasmonicdevices is the combination of strong electromagnetic oscillation localization combined with high frequencies ofthese oscillations, which in turn leads to a gigantic amplification of local optical and electromagnetic fields [1]. The localizedplasmons parameters depend on the shape of the nanoparticles, which allows to fine tune their resonance systemto effectively interact with light and other quantum systems (quantum dots, molecules) [2].

Some of the possible applications of these effects are highly effective tunable fluorophores and nanosized lightsources as well as surface plasmon amplification by simulated emission of radiation. It is also possible to create micromechanicaloscillators(Fig. 1), using highly conducting microcantilevers and carbon nanotubes as mechanicaly floating gates [3].Such devices exhibit not only mechanical resonance, but also resonance at frequencies of plasma oscillations.

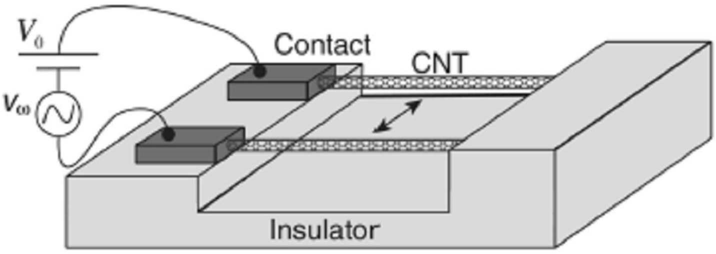

Fig. 1. General view of device under consideration

In detectors, such as the one presented above, it is possible to induce a parametric balance if the amplitudeof the input signal exceeds some threshold value. When this happens, low frequency mechanical vibrations are inducedin the resonator even in the absence of the carrier frequency modulation [4]. Presenting the plasma and mechanicaldistributions of the resonators as lumped parameters it is possible to write out a set of equations for associated resonators,the solution of which will allow evaluate the threshold value of the input signal: Eq. (1):

$$\begin{cases} y+\gamma_m y+\omega_m^2 y=-\frac{2\eta\rho}{M_l d} \\ \rho+\gamma_e\rho+\omega_e^2\left(1+\zeta\frac{\upsilon_{ED}^2}{v_\varphi^2}\frac{y}{d}\right)\rho=\frac{4}{\pi}\omega_e^2 C_l\delta\varphi(t) \end{cases} \quad (1)$$

This paper is an attempt to estimate the threshold amplitude of the AC input signal, exceeding which will result in self-inducedmechanical oscillations.

1. D. J. Bergman, M. I. Stockman, Surface Plasmon Amplification by Stimulated Emission of Radiation: Quantum Generationof Coherent Surface Plasmons in Nanosystems, Phys. Rev. Lett. 90 027402 (2003)

2. D.V. Guzatov, V.V. Klimov, Radiative decay engineering by triaxialnanoellipsoids, Chem. Phys. Lett. 412 341 (2005).

3. M. I. Dyakonov, M. S. Shur, Shallow water analogy for a ballistic field effect transistor: New mechanism of plasmawave generation by dc current, Phys. Rev. Lett. 71 2465 (1993).

4. ViacheslavSemenenko, and Victor Ryzhii, Detection of Modulated Terahertz Radiation Using Combined Plasma andMechanical Resonances in Double-Carbon-Nanotube Device, Applied Physics Express 4 075101 (2011).