

Sławomir Drobczyński
Tadeusz Martynkien
Department of Optics and Photonics
Technology
Wrocław University of Science and Technology Wyb. Wyspiańskiego 27,
Wyb. Wyspiańskiego 27,
50-370 Wrocław, Poland

Ewa Popko
Department of Quantum Technologies
Wrocław University of Science and
Technology
Wyb. Wyspiańskiego 27,
50-370 Wrocław, Poland

Jakub Niemczuk
Faculty of Microsystem Electronics and Photonics
Wrocław University of Science and Technology
Janiszewskiego 11/17, 50-372 Wrocław, Poland

The use of optical trap for random number generation

Keywords: optical trap, Brownian motion, random number generator, FPGA

ABSTRACT

Random number generators are important devices applicable in many fields of science such as cryptography, statistics or Monte Carlo simulations. The random number generation proposed in this paper is based on the observation of the movement of microspheres, captured in an optical trap. The vibrations of the spheres around the position of the equilibrium are caused by its collisions with the molecules of the liquid performing Brownian motion. Microscopic system equipped with a quadrant photodiode allows for the detection of the trapped microspheres' vibrations. The photovoltage signals proportional to the movement of the spheres in the X and Y directions are recorded using FPGA-based layout. A recorder equipped with analog-to-digital converters and memory RAM is used for sampling and analysis of the vibration signal.