

# **Numerical Investigation of the Effect of Some Parameters on the Noise Characteristic of Semiconductor Nanowire Field Effect Transistor, in order to Improve Performance**

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**Nanowire field-effect transistors have been widely studied in last decade to introduce as a promising option to continue miniaturization process as new generation transistors. Due to their unique electronic properties, nanowires are highly regarded. Body thickness (diameter) of nanowires can be well controlled and reduced to below 10 nm. So nanowires can be used as channels in transistors. Gate-All-Around nanowire MOSFETS are the best solution to minimize the distributing short channel effects. Noise limits the minimum signal level which can be detected and processed by a circuit with acceptable quality and effects loss of power, speed and the amount of linearity of the circuit. So, due to the increasing proliferation of studies on nanowire field effect transistors, investigation on noise phenomenon and efforts to reduce it in this device is important. It is notable that the most percentage of studies on noise phenomenon in nanowire MOSFETS are related to obtaining noise power spectral density in laboratory and the lack of researches based on simulation is obvious. First, we study noise theory and introduce the calculation methods of flicker, thermal and shot noise power spectral densities in semiconductor nanowire MOSFETs. Then, by using two powerful quantum simulation software named OMEN Nanowire and Nanowire in which calculations are based on non-equilibrium Green's function (NEGF), we obtain the current-voltage curves of gate-all-around silicon nanowire MOSFETs by changing some parameters like nanowire(channel) length and diameter, gate oxide thickness and material, source and drain doping, drain voltage and carrier transfer type. Next, by using MATLAB, we obtain the curves related to noise power spectral densities and then analyze them and compare them to each other. The**

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results show that noise power spectral density changes are proportional to drain current, drain current changes to gate voltage changes ratio and gate capacitance.

**Keywords :** Silicon Nanowire Field-Effect Transistor, Flicker noise, Shot noise, Thermal noise, Non-equilibrium Green's function

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