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**Topic of Research:** Design and Performance Analysis of Nanoelectronic Devices using Advanced Materials

**Department:** Electronics and Communication Engineering

**Keywords:** CNTFET, GNRFET, Filters, Integrators, Monte Carlo Simulations, Instrumentation Amplifier

### **Findings**

- The CNTFETs stands out as a high end prospect among emerging electronic devices, including TFET, SET, and NWFET, offering an extension beyond conventional Silicon MOSFET technology. Due to the superior characteristics of CNTFET compared to bulk CMOS, it necessitates the establishment of new design methodologies. The literature continually evolves with the development of CNTFET models and their performance assessments. The performance outcomes of circuits based on CNTFET are sufficiently robust to surpass those of bulk CMOS.
- The research work examined the impact of varying CNT parameters like diameter, number of tubes, and CNT pitch on performance metrics, emphasizing the importance of adjusting each parameter in simulations.
- Lowering the technology node further enhanced these performance parameters in CNTFET devices. Within the OTA framework, CNTFETs demonstrated a remarkable combination of high gain and low noise, enabling low-power circuit operation while maintaining stability.
- Comprehensive studies, including temperature and Monte Carlo analyses, were conducted on the CNTFET-based op-amps. These analyses demonstrated the amplifier's excellent performance in mitigating the effects of temperature variations, supply voltage fluctuations, and device parameter variations within acceptable limits.
- Simulating filter applications confirmed the practicality of the proposed designs, highlighting their potential for use in low-power and low-voltage scenarios with enhanced performance.

- An integrator was designed and simulated to validate the proposed circuits' applicability, with CNTFET-IFFC-2SOAs integrators demonstrating better performance than conventional CMOS-IFFC-2SOA integrators. Additionally, an instrumentation amplifier based on the pure CNTFET-IFFC-2SOA was proposed, demonstrating superior performance compared to traditional CMOS-based IFFC-2SOA designs.
- Additionally, a comparative analysis between CNTFET-FC-OTA and GNRFET-FC-OTA using HSPICE software showed increased gain and reduced power consumption in CNTFET-FC-OTAs compared to both CMOS and GNRFET devices.