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(57) Abstract :
As semiconductor with the progression of semiconductor technology, the demand for high-performance, low-power, and economical VLSI architectures is steadily increasing. This study examines advanced VLSI architectures and design approaches specifically developed for next-generation digital applications, such as AI, IoT, 5G, and high-performance computing (HPC). Significant breakthroughs encompass low-power design methodologies, AI-enhanced VLSI automation, multi-core processing, hardware accelerators (such as GPUs, TPUs, and NPUs), and 3D-IC integration. Furthermore, novel paradigms such neuromorphic computing, processing-in-memory (PIM), and quantum-inspired circuits are being explored to improve efficiency and scalability. Security and dependability are ensured by post-quantum cryptography accelerators and self-repairing VLSI circuits. These improvements facilitate the development of next-generation AI-driven, energy-efficient, and high-speed computing systems, positioning VLSI as a crucial facilitator of future digital technologies.

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