**EFFICIENT MODULAR ADDER DESIGNS BASED ON THERMOMETER AND ONE-HOT CODING**

**Abstract:**

Residue Number Systems (RNSs) are efficient alternatives to positional number systems, providing fast and power-efficient computational systems. The key feature of RNS benefitting modern embedded systems and Internet-of-thing (IoT) edge devices is its energy efficiency. Modular addition is the most important and frequent operation applied on the components of RNS, including arithmetic units in the channels as well as forward and reverse converters. The small and medium dynamic range requirements of low-power embedded and edge devices make the usage of the thermometer and one-hot coding viable, reducing the power consumption and improving the energy efficiency of modulo addition in comparison to regular binary representations. Based on these techniques, this paper presents two new energyefficient modular adders, which due to the carry-free internal computations, are also highly performant. The proposed modular adders, based on the thermometer and one-hot coding result in average improvements of 38% and 34.5% for the delay, 27% and 14.5% for the circuit area, 29.5% and 6.3% for energy consumption, and about 54.9% and 44.2% for the area-delay product (ADP), respectively, in comparison with the related state of the art.

**Index Terms—**Residue Number System, Computer Arithmetic, Modular addition, Thermometer Coding, One-hot Coding

**TOOLS:**

1. **XilinxISE 14.7**

**LANGUAGE:**

1. **VerilogHDL**