VLSI IMPLEMENTATION OF LOW-POWER AND HIGH-SFDR DIGITAL FREQUENCY SYNTHESIZER FOR UNDERWATER INSTRUMENTS AND NETWORK SYSTEMS

莊英慎,宋志雲,Hsi-Chin Hsin
Electronics Engineering
Engineering
bobsung@chu.edu.tw

Abstract

COordinate Rotation DIgital Computer (CORDIC) is an efficient algorithm for computations of trigonometric functions. Scaling-free-CORDIC is one of the famous CORDIC implementations with advantages of speed and area. In this paper, a novel direct digital frequency synthesizer (DDFS) based on scaling-free CORDIC is presented. The proposed multiplier-less architecture with small ROM (-bit) and pipeline data path has advantages of high data rate, high precision, high performance, and less hardware cost. The design procedure with performance and hardware analysis for optimization has also been given. It is verified by Matlab® simulations and then implemented with FPGA (field programmable gate array) by Verilog®. The spurious-free dynamic range (SFDR) is 118.2 dBc, and the signal-to-noise ratio (SNR) is 81.12 dB. The scaling-free CORDIC based architecture is suitable for VLSI implementations for the DDFS applications in terms of hardware cost, power consumption, SNR, and SFDR. The proposed DDFS is very suitable for underwater instruments and network systems.

Keyword：DDFS, scaling-free-CORDIC, SFDR, SNR, FPGA, VLSI, underwater instruments and network systems.