

## **FPGA Implementation of Novel Triangular Systolic Array Based Architecture for Determining the Eigenvalues of Matrix**

**Authors :** Soumitr Sanjay Dubey, Shubhajit Roy Chowdhury, Rahul Shrestha

**Abstract :** In this paper, we have presented a novel approach of calculating eigenvalues of any matrix for the first time on Field Programmable Gate Array (FPGA) using Triangular Systolic Arra (TSA) architecture. Conventionally, additional computation unit is required in the architecture which is compliant to the algorithm for determining the eigenvalues and this in return enhances the delay and power consumption. However, recently reported works are only dedicated for symmetric matrices or some specific case of matrix. This works presents an architecture to calculate eigenvalues of any matrix based on QR algorithm which is fully implementable on FPGA. For the implementation of QR algorithm we have used TSA architecture, which is further utilising CORDIC (CO-ordinate Rotation DIgital Computer) algorithm, to calculate various trigonometric and arithmetic functions involved in the procedure. The proposed architecture gives an error in the range of 10<sup>-4</sup>. Power consumption by the design is 0.598W. It can work at the frequency of 900 MHz.

**Keywords :** coordinate rotation digital computer, three angle complex rotation, triangular systolic array, QR algorithm

**Conference Title :** ICCD 2016 : International Conference on Computer Design

**Conference Location :** Zurich, Switzerland

**Conference Dates :** January 12-13, 2016