FPGA PROJECT – QUADRATIC SOLVER

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Description

This project using the DE10 Lite board will showcase the functionality of a quadratic equation solver. The board will compute the approximate real roots of the function given by the user.

Uses of Combinational and Sequential Logics

- Combinational logic must be used to implement the various functions needed to calculate the real roots, such as:
    - Adder/subtractor circuits.
    - Multiplier/divisor circuits.

- Sequential logic is used to optimize the user input experience when inserting the quadratic equation. A FSM is used to increment the state of the circuit representing each stage of the user input and the displaying of the calculated result.

Testable Features

- User interface used to create the values needed for the quadratic equation:

$$y = Ax^2+Bx+C$$

    - For parameters A, B and C, the user can set these values by toggling the switches representing each 7.S.D, and then increment/decrement the selected 7.S.Ds using buttons.

- Display calculations from the user inputs using the quadratic formula:

$$x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$$

    - On the 7.S.Ds, display the correct value for $B^2 – 4AC$ and $\sqrt{B^2 - 4AC}$.
    - On the 7.S.Ds, display the real root(s) of the inserted quadratic function: X_1 & X_2, or display “NRR” if there are no real roots.

Results

Video Demo: https://youtu.be/hSoHo_MV8Y4