EE214
Debouncing a switch

The action of pressing a push-button or changing the position of a switch is expected to create a clean 1 to 0 (or 0 to 1) transition. In practice, mechanical inertia causes this transition to not be clean. In particular,

- The output of the push-button/switch will take time to settle (typically a few milli-seconds).
- During this settling period, the output may touch 0 and 1 several times.

A debouncing circuit is used to clean up the output of the push-button/switch. A finite-state machine may be used for this purpose.

The finite-state machine can work as follows: the switch output is checked every $10ms$, and the output of the finite-state machine is 1 (respectively, 0) if the last two values that were checked are 1 (respectively, 0).

1. From a $50MHz$ clock, generate a lower frequency $100MHz$ clock (use a divide by 5000 counter, obtained by cascading multiple divide by 2 or divide by 4 counters).
2. Using this $100Hz$ clock, design a debouncing FSM which has a single input from the switch/push-button (and also a reset), and a single output which produces clean switching between 0 and 1. The design should use two input gates, inverters and D flip-flops.
3. Describe your design in VHDL and confirm using a simulation test-bench that it works as expected.
4. Map your design to the Krypton kit using a push-button to generate the input, a switch for the reset and an LED for the output and check if things work correctly.

5. Confirm using a DSO (oscilloscope) that the output signal generated by your circuit is cleaned up. Also observe the output of the switch and report it.