

ODE Solver Design Report

Mahmoud Adas
Section:2, BN:21

Evram Youssef
Section:1, BN:9

Remonda Talaat
Section:1, BN:20

Mohamed Shawky
Section:2, BN:16

March 20, 2020

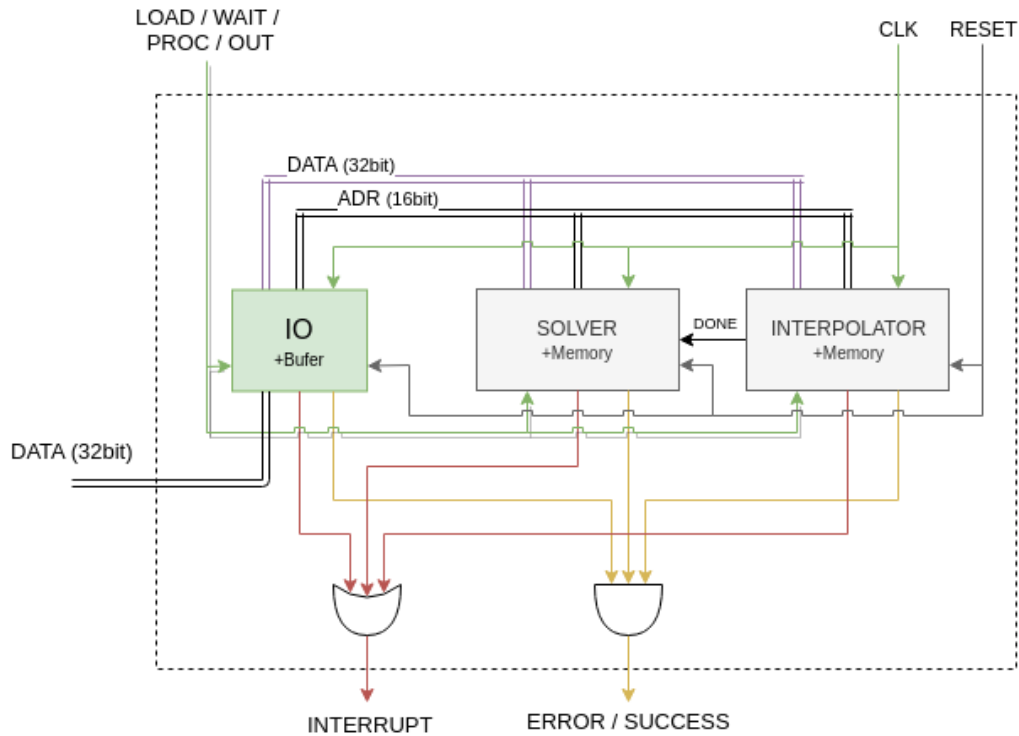


Figure 1: Overall Design

1 Interfaces and HW Summary

The hardware has the following interfaces that triggers some actions summarized below and detailed in the rest of the document.

- CLK: IN
- RESET: ASYNC IN
 - clears all internal states of all modules:
 - * IO internal buffer.
 - * ERROR/SUCCESS of all modules resets to SUCCESS.
 - * INTERRUPT resets to zero.
 - Memory at solver and interpolator are NOT cleared.
 - at next clock, CPU is expected to turn the *LOAD* / *WAIT* / *PROC* / *OUT* into *LOAD* state and we will start loading input again.
- LOAD / WAIT / PROC / OUT (2bit): IN:
 - set the current major state of the machine
 - LOAD(0):
 - * IO receives **compressed** data from the CPU.
 - * IO decompresses data into buffer.
 - * buffer is flushed into data bus with appropriate address.
 - * ends when cpu finishes its data loading and switches to *WAIT* state.
 - WAIT(1):
 - * Same state as *LOAD*, but IO doesn't receive anymore data from CPU.
 - * ends when IO flushes all its buffer and raises *INTERRUP* with either *ERROR* or *SUCCESS*.
 - PROC(2):
 - * SOLVER sends time step to calculate *U* at.
 - * SOLVER and INTERPOLATOR work concurrently to calculate their outputs.

- * INTERPOLATOR sends *DONE* signal to SOLVER when it finishes the interpolated *U*.
 - * SOLVER can request to copy the interpolated *U*.
 - * INTERPOLATOR waits for SOLVER to send next time step.
 - * ends when either SOLVER or INTERP raises INTERRUPT with either *SUCCESS* or *ERROR*.
- OUT(3):
 - * IO just copies final outputs to cpu from SOLVER memory.
 - * ends when IO raises INTERRUPT with either *SUCCESS* or *ERROR*.
- DATA (32bit): INOUT
 - Data bus between cpu and io.
- INTERRUPT: OUT
 - raised from 0 to 1 when some internal module (IO / SOLVER / INTERPOLATOR) finishes its task.
 - if task finished with success the *ERROR* / *SUCCESS* is set to *SUCCESS*, otherwise it's *ERROR*.
- ERROR(0) / SUCCESS(1): OUT
 - CPU should operate on this value ONLY when *INTERRUPT* is 1.
 - errors that could happen include: divide by zero, $H \neq 1$, incomplete input.