An Event-B Specification of c1
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CONTEXT c1

Context for a model of the Bosch switchc mini-pilot Michael Butler 16 May 2008

I represent the continuous input as a function from Time to Signal value. As a first approximation, I have modelled time and signal value as natural numbers.

so we have a constant input : NAT –¿ NAT

and input(t) represents the value of the input signal at time t.

The SwitchOn and SwitchOff conditions are then defined in terms of the continuous input.

The discrete behaviour of the switch is defined in teh machine

CONSTANTS

$input$

RTH

FTH

CT

BT

$RisingEdge$

$SwitchOnCond$

$FallingEdge$

$SwitchOffCond$

AXIOMS

$axm1: input \in \mathbb{N} \rightarrow \mathbb{N}$
input is a funtion from time to the range off..on

$axm8: RTH \in \mathbb{N}$
Rising threshold

$axm7: FTH \in \mathbb{N}$
Falling threshold

$axm4: FTH < RTH$

$axm9: CT \in \mathbb{N}$
Cycle time

$axm10: BT \in \mathbb{N}$
Debounce time

$axm5: CT < BT$

$axm6: RisingEdge \subseteq \mathbb{N}$
t in RisingEdge means rising edge detectable at time t

$axm11: \forall t \cdot t \geq CT \Rightarrow$
$(t \in RisingEdge \Leftrightarrow$
$input(t) > RTH \wedge$
$input(t - CT) < RTH)$
Time t represents a rising edge iff
the input at time t is higher than RTH and at time t-CT the input was lower than RTH

$axm2: SwitchOnCond \subseteq \mathbb{N}$
t in SwitchOnCond means that teh swtch on condition holds at time t.

$axm3:\ \forall t\cdot$
$$t \in \mathbb{N} \Rightarrow (t \in SwitchOnCond \Leftrightarrow (\exists t0 \cdot t0 \in \mathbb{N} \land t0 < t \land t0 \in RisingEdge \land t - t0 \geq BT \land (\forall i \cdot i \in t0 \mathinner{..} t \Rightarrow input(i) > RTH)))$$

The switch on condition is true at time t iff

a rising edge was detected some time previously (t0) and the input exceeds RTH for BT after the rising edge

$axm12:\ FallingEdge \subseteq \mathbb{N}$

$axm14:\ \forall t \cdot t \geq CT \Rightarrow (t \in FallingEdge \Leftrightarrow input(t) < FTH \land t - CT \in \mathbb{N} \land input(t - CT) > FTH)$

Time t represents a rising edge iff

the input is lower than FTH and at time t-CT the input was greater than FTH

$axm13:\ SwitchOffCond \subseteq \mathbb{N}$

$axm15:\ \forall t \cdot t \in \mathbb{N} \Rightarrow (t \in SwitchOffCond \Leftrightarrow (\exists t0 \cdot t0 \in \mathbb{N} \land t0 < t \land t0 \in FallingEdge \land t - t0 \geq BT \land (\forall i \cdot i \in t0 \mathinner{..} t \Rightarrow input(i) < FTH)))$

The switch off condition is true at time t iff

a falling edge was detected some time previously (t0) and the input is lower than RTH for BT after the falling edge

END