

# Pulser Circuit

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Here, we present a modular  $\mathcal{EVT}$ -specification corresponding to the Event-B specification of a single pulser circuit as presented in Chapter 8 of Abrial's book.

```

1 spec DATAM0 =
2   ops circuit : Bool
3     push, pop, flash : ℕ
4     . pop ≤ push
5     push ≤ pop + 1
6     flash ≤ push
7     push ≤ flash + 1
8     circuit = FALSE
9     ⇒ flash = push ∨ flash = pop
10 end

11 spec ENV0 =
12   DATAM0 then
13   Events
14     env =
15       when circuit = FALSE
16       thenAct circuit = TRUE
17 end

18 spec CIR0 =
19   ENV0 with {env ↦ cir, FALSE ↦ TRUE,
20             TRUE ↦ FALSE}
21 end

1 spec M0 =
2   ENV0 with {env ↦ env2}
3   and ENV0 with {env ↦ env3}
4   and CIR0 with {cir ↦ cir1}
5   and CIR0 with {cir ↦ cir2}
6   then
7   Events
8     Init =
9       thenAct circuit := FALSE
10        push := 0
11        pop := 0
12        flash := 0
13
14     env1 =
15       when pop = push
16       thenAct push := push + 1
17
18     env2 =
19       when pop ≠ push
20       thenAct pop := pop + 1
21
22     cir1 =
23       when push ≠ flash
24       thenAct flash := flash + 1
25
26     cir2 =
27       when push ≠ pop ∨ push = flash
28 end

```

**Fig. 1.** The abstract model

```

1 spec M1.1 =
2   M0 then
3     . circuit = FALSE ∧ pop ≠ push
4     ⇒ flash ≠ pop
5     circuit = FALSE ∧ pop ≠ push
6     ⇒ flash = push
7   Events
8     cir2 =
9       when push = flash
10 end

1 spec M1.2 =
2   M0 then
3     . pop ≠ push ⇒ flash ≠ push
4     pop ≠ push ⇒ flash = pop
5   Events
6     cir1 =
7       when push = pop
8 end

```

**Fig. 2.** The first refinement

```

1 spec DATAM2 =
2   ops input, output, reg : Bool
3   . input = TRUE  $\iff$  pop  $\neq$  push
4   circuit = FALSE  $\Rightarrow$  reg = input
5   Events
6   Init =
7     thenAct input := FALSE
8     output := FALSE
9     reg := FALSE
10 end

11 spec ENV21 =
12   DATAM2 then
13     Events
14     env =
15       when input = FALSE
16       thenAct input := TRUE
17 end

18 spec CIR21 =
19   DATAM2 then
20     Events
21     cir =
22       thenAct output := TRUE
23       reg := input
24 end

1 spec M.2.1 =
2   M.1.1 and DATAM2 and
3   ENV21 with {env  $\mapsto$  env1} and
4   ENV21 with {env  $\mapsto$  env2, FALSE  $\mapsto$  TRUE,
5     TRUE  $\mapsto$  FALSE} and
6   CIR21 with {cir  $\mapsto$  cir1} and
7   CIR21 with {cir  $\mapsto$  cir2, TRUE  $\mapsto$  FALSE}
8   then
9     . circuit = TRUE
10     $\Rightarrow$  (input = TRUE  $\wedge$  reg = FALSE  $\iff$ 
11      push  $\neq$  flash)
12    Events
13    cir1 =
14      when input = TRUE
15      reg = FALSE
16    cir2 =
17      when input = FALSE  $\vee$  reg = TRUE
18 end

18 spec M.2.2 =
19   M.1.2 and DATAM2 and
20   ENV21 with {env  $\mapsto$  env1} and
21   ENV21 with {env  $\mapsto$  env2, FALSE  $\mapsto$  TRUE,
22     TRUE  $\mapsto$  FALSE} and
23   CIR21 with {cir  $\mapsto$  cir1} and
24   CIR21 with {cir  $\mapsto$  cir2, TRUE  $\mapsto$  FALSE}
25   then
26     Events
27     cir1 =
28       when input = FALSE
29       reg = TRUE
30     cir2 =
31       when input = TRUE  $\vee$  reg = FALSE
32 end

```

Fig. 3. The second refinement step

```

1 spec REFCIR1 =
2   DATAM2 then
3     Events
4     cir =
5       thenAct output := bool(input = TRUE
6          $\wedge$  reg = FALSE)
7       reg := bool(input = TRUE)
8   end

9 spec REFCIR2 =
10   DATAM2 then
11     Events
12     cir =
13       thenAct output := bool(input = FALSE
14          $\wedge$  reg = TRUE)
15       reg := bool(input = TRUE)
16   end

1 spec M.3.1 =
2   M.2.1 and
3   REFCIR1 with {cir  $\mapsto$  cir1} and
4   REFCIR1 with {cir  $\mapsto$  cir2}
5   end

6 spec M.3.2 =
7   M.2.2 and
8   REFCIR2 with {cir  $\mapsto$  cir1} and
9   REFCIR2 with {cir  $\mapsto$  cir2}
10  end

```

Fig. 4. The third refinement step

```
1 spec M.4.1 =  
2   M.3.1 with {cir1  $\mapsto$  pul1, cir2  $\mapsto$  pul1}  
3 end  
  
4 spec M.4.2 =  
5   M.3.2 with {cir1  $\mapsto$  pul1, cir2  $\mapsto$  pul1}  
6 end
```

**Fig. 5.** The fourth refinement step