gate_pulse_1.ece

```
  mainnodes: y1_out y2_out gnd
  ind_nodes: node_sense_1 node_sense_2
  rparms:
+   alpha=90 beta=10
+   r=55.555556 c=1u v_high=1
+   epsl=1e-6 delta_tmin=0.01m delta_tnrml=0.1m
```

Description

`gate_pulse_1.ece` is used to produce signals to drive switches in certain power electronic circuits. It senses the voltages at nodes `node_sense_1` and `node_sense_2` and generates two output signals, one between `y1_out` and `gnd` and the other between `y2_out` and `gnd`. The node `gnd` must be *externally* made the same as the circuit reference node.

The parameters `alpha` and `beta` are angles (in degrees) and are used to describe time intervals, one "period" (T) corresponding to 360°. Note that T is not entered separately as a real parameter. Instead, values of some fictitious resistor (R) and capacitor (C) are entered as parameters `r` and `c`, respectively, and T is computed internally as $T = 360 \times RC$.

We now describe how the output pulses are obtained from the input signals. Let $v' = v(\texttt{node\_sense\_1}) - v(\texttt{node\_sense\_2})$. The zero crossing of v' (from 0^- to 0^+) is detected. Say, the zero crossing occurs at time t_0. Then, one pulse is produced `alpha` degrees after t_0, with a duration of `beta` degrees and going from 0 to `v_high`. The other pulse is produced in a similar manner except that the zero crossing from 0^+ to 0^- serves as the trigger in that case.

There are a few other parameters for gate_pulse_1.ece; however, their default values would generally work fine for power electronic applications. These parameters are therefore not required to be assigned in the circuit file.

The parameters `delta_tmin` and `delta_tnrml` are used for controlling the simulator time steps. Additional time points are forced, depending on the values of `delta_tmin` and `delta_tnrml`. This feature allows accurate simulation without having to make the average time step very small. Generally, `delta_tnrml` should be made equal to the typical simulator time step (`delt_const`) while `delta_tmin` should be made much smaller (say, by a factor of 100).

AC behaviour is not implemented.

Fig. 1 shows typical waveforms obtained with gate_pulse_1.ece. The corresponding circuit file (available as gate_pulse_1_ece.in in the examples directory) is reproduced below.

```
title: testing of gate_pulse_1.ece

begin_circuit
   eelement type=vsrcac p=a n=0 a=1 f_hz=50 phi=-20

   eelement type=gate_pulse_1
+     node_sense_1=a node_sense_2=0
+     y1_out=y1 y2_out=y2 gnd=0
+     alpha=120 beta=20
+     delta_tmin=0.001m delta_tnrml=0.1m
+     r=55.555556 c=1u v_high=1

   refnode=0

   outvar:
+     va=nodev_of_a
+     vy1=nodev_of_y1
+     vy2=nodev_of_y2
end_circuit

begin_solve
   solve_type=startup
   initial_sol initialize
   method: t_startup=0
end_solve

begin_solve
   solve_type=trns
   initial_sol previous
   begin_output
      filename=gate_pulse_1_ece.dat
      variables: va vy1 vy2
   end_output
   method: itmax_trns=100000
+    back_euler=yes
+    t_start=0 t_end=40m delt_const=0.1m delt_min=0.001m
end_solve

end_cf
```

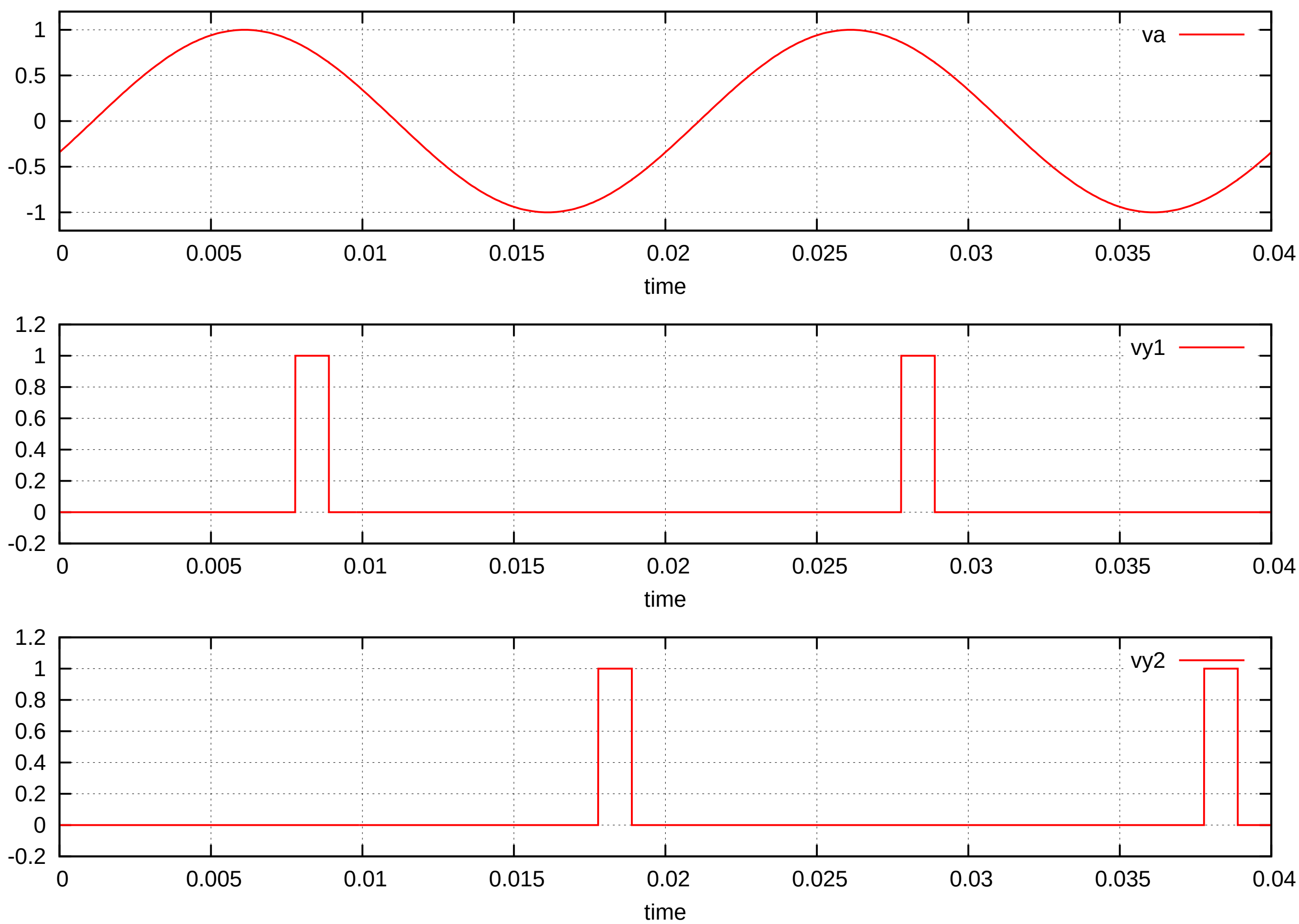

Figure 1: Waveforms obtained with `gate_pulse_1.ece` (see the circuit file for details).