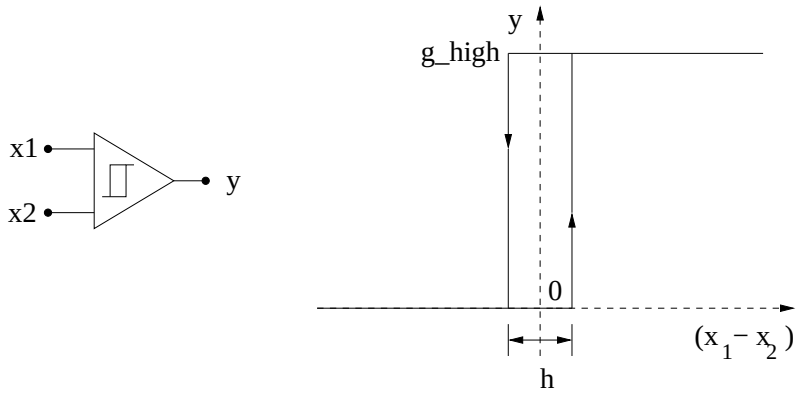

Figure 1: `cmprtr_hyst_1.gce`: input-output relationship.

cmprtr_hyst_1.gce

Attributes

```
  mainvars: x1 x2 y
  rparms: g_high=1.0 epsl=1.0e-6 delta_tmin=1.0e-6
+    delta_tnrml=1.0e-3 h=0.1
```

Description

`cmprtr_hyst_1.gce` is a comparator with hysterisis. It compares general variables x1 and x2. The input-output relation is as shown in Fig. 1.

The parameters `delta_tmin`, `delta_tnrml`, and `epsl` are used for controlling the simulator time steps. Additional time points are forced, depending on the values of `delta_tmin` and `delta_tnrml`, when $(\texttt{x1} - \texttt{x2}) \pm \texttt{h}/2 \leq \texttt{epsl}$. 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. 2 shows typical waveforms obtained with `cmprtr_hyst_1.gce`. The corresponding circuit file (available as `cmprtr_hyst_1_gce.in` in the examples directory) is reproduced below.

```
title: testing of cmprtr_hyst_1

begin_circuit
   gelement type=triangle_2 y=x1 i0=0 tperiod=8m t0=0
+     g_high=1 g_low=-1 epsl=1u
   gelement type=triangle_2 y=x2 i0=1 tperiod=8m t0=0
+     g_high=1 g_low=-1 epsl=1u
   gelement type=cmprtr_hyst_1 x1=x1 x2=x2 y=y g_high=1.2 epsl=1.0e-15
+     delta_tmin=0.2u delta_tnrml=0.80m h=0.5

   outvar:
+     x1=var_of_x1
+     x2=var_of_x2
+     y=var_of_y
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=cmprtr_hyst_1_gce.dat limit_lines=10000
      variables: x1 x2 y
   end_output
   method: itmax_trns=10000
+    back_euler=yes
+    t_start=0 t_end=20m delt_const=0.80m delt_min=0.10u
+    n_wrtiterno=1000
end_solve

end_cf
```

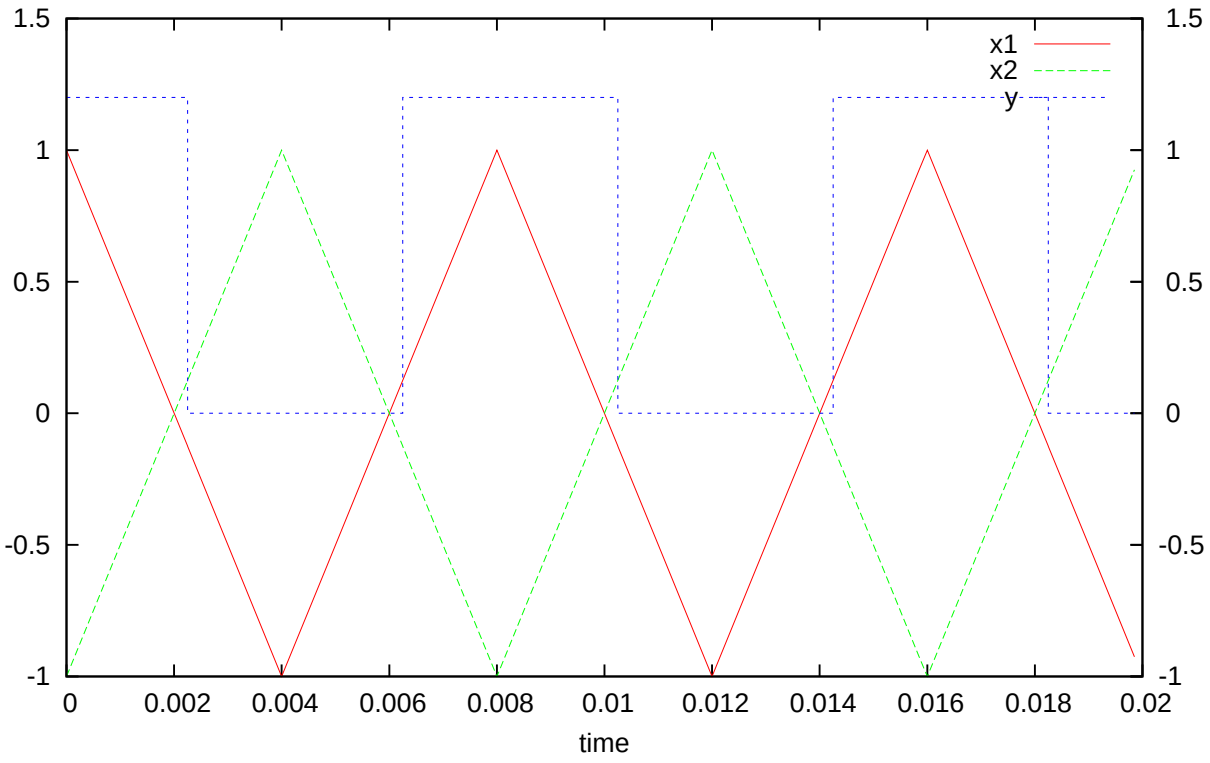

Figure 2: Waveforms obtained with `cmprtr_hyst_1.gce` (see the circuit file for details).