0.0.1 Current-Controlled Voltage Source **H**

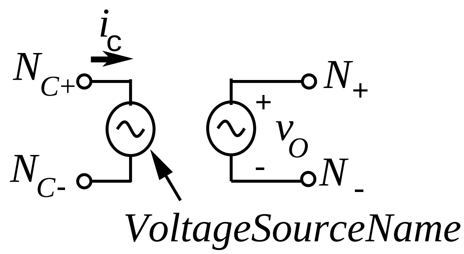

Figure 1: H — current-controlled voltage source element.

Form:
`Hname` N_+ N_- *VoltageSourceName Transresistance*
`Hname` N_+ N_- `POLY( D )` $VoltageSourceName_1$ ... $VoltageSourceName_D$ *PolynomialCoefficients*

N_+	is the positive voltage source node.
N_-	is the negative voltage source node.
VoltageSourceName	is the name of the voltage source the current through which is the controlling current. The voltage source must be a `V` element.
Transresistance	is the Transresistance of the element.
`POLY`	is the identifier for the polynomial form of the element.
D	is the degree of the polynomial. The number of pairs of controlling nodes must be equal to *Degree*.
$VoltageSourceName_i$	is the name of the voltage source the current through which is the ith controlling current. The voltage source must be a `V` element.
PolynomialCoefficients	is the set of polynomial coefficients which must be specified in the standard polynomial coefficient format discussed in the description.

Example:
```
H1 2 3 14 1 2.0
```

Description:
Polynomial expressions can be used with the controlled source elements (`E`, `F`, `G` and `H`) to realize nonlinear controlled sources. The specification of the polynomial must be at the end of the input line and has two forms.

The format for a current-controlled voltage source (the `H` element) is

`POLY(`N`)` $VoltageSourceName_1$ ... $VoltageSourceName_N$ C_0 C_1 C_2 C_3 ...

where

`POLY`	is the keyword indicating that that a polynomial description follows.
N	is the degree of the polynomial.
$VoltageSourceName_1$	is the name of the voltage source the current through which is control current I_1.
$VoltageSourceName_N$	is the name of the voltage source the current through which is control current I_N.
$C_0\ C_1\ \ldots$	are the polynomial coefficients.

For these elements the output is calculated as

$$\begin{aligned}
\text{OUTPUT} &= C_0 \\
&+C_1V_1+\ldots+C_NV_N \\
&+C_{N+1}V_1V_1+C_{N+2}V_1V_2+\ldots+C_{N+N}V_1V_N \\
&+C_{2N+1}V_2V_2+C_{2N+2}V_2V_3+\ldots+C_{2N+N-1}V_2V_N \\
&\vdots \\
&+C_{N!/(2(N-2)!)+2N}V_NV_N \\
&+C_{N!/(2(N-2)!)+2N+1}V_1V_1V_1+C_{N!/(2(N-2)!)+2N+2}V_1V_1V_2 \qquad (1)\\
&\qquad +\ldots+C_{N!/(2(N-2)!)+2N+N-1}V_1V_1V_N \\
&+C_{N!/(2(N-2)!)+3N}V_1V_2V_2+\ldots+C_{N!/(2(N-2)!)+3N+N-2}V_1V_2V_N \\
&\vdots \qquad (2)
\end{aligned}$$

An example of a current-controlled voltage source is:

H1 2 3 POLY(2) VIN V2 0.5 1 1 0.2 0.3 0.2

Linear Transresistance Instance

`H`*name* N_+ N_- N_{C+} N_{C-} *Transresistance*

The value of the voltage generator is linearly proportional to the controlling current:

$$v_o = Transresistance\, v_c \tag{3}$$

`POLY`nomial Instance

`H`*name* N_+ N_- `POLY(` D `)` `(`N_{C1+} N_{C1-}`)` ... `(`N_{CD+} N_{CD-}`)` *PolynomialCoefficients*

The value of the voltage generator is a polynomial function of the controlling voltages:

$$v_o = f(i_{c1}, ..., i_{ci}, ...i_{cD} \tag{4}$$

where the number of controlling currents is D — the degree of the polynomial specified on the element line. i_{ci} is the ith controlling current and is the current flowing from the +

terminal to the − terminal in the ith voltage source of name *VoltageSourceName*.

Notes:
The actual element in *f*REEDA™ is the `H` element. See `H` for full documentation.

Credits:

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