Current-Controlled Current Source cccs

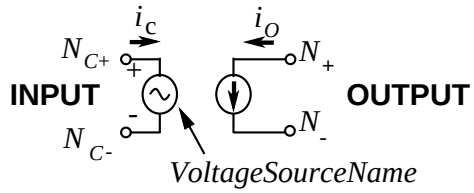

Figure 1: Current-controlled current source element.

Form: `cccs:`⟨`instance name`⟩ n_1 n_2 $\cdots$ ⟨`parameter list`⟩
n_1, n_2 $\cdots$ are the element nodes.
Parameters:

Parameter	Type	Default value	Required?
g: Transconductance (Siemens)	DOUBLE	n/a	yes
ri: Input resistance value(Ohms)	DOUBLE	0	no
ro: Output resistance value(Ohms)	DOUBLE	0	no
$\text{poly}_{\text{coeff}}$: Coefficients of polynomial	DOUBLE VECTOR	See source file.	no
polydimension: Dimension of polynomial	INTEGER	1	no

Example:
```
CCCS1 5 0 POLY(1) 3 2 1 2.5
```

Description:
The current controlled current source is either a linear or nonlinear function of controlling branch currents, depending on whether the polynomial is used or not.

Polynomial Functions:
The controlled element statement allows the definition of the controlled current source as a polynomial function of one or more voltages. Three polynomial equations can be used through the POLY(N) parameter. POLY(1) one-dimensional equation, POLY(2) two-dimensional equation, POLY(3) three-dimensional equation. The POLY(1) polynomial equation specifies a polynomial equation as a function of one controlling variable, POLY(2) as a function of two controlling variables, and POLY(3) as a function of three controlling variables. Along with each polynomial equation are polynomial coefficient parameters $(P_0, P_1 \cdots P_n)$ that can be set to explicitly define the equation.

One-Dimensional Function:
If the function is one-dimensional (a function of one branch current), the function value FV is determined by the following expression:

$$FV = P_0 + (P_1.FA) + (P_2.FA^2) + (P_3.FA^3) + (P_4.FA^4) + (P_5.FA^5) + \cdots \quad (1)$$

FV controlled current from the controlled source,

$P_0 \cdots P_n$ coefficients of polynomial equation,

FA controlling branch current.

If the polynomial is one-dimensional and exactly one coefficient is specified, *f*REEDA™assumes it to be $P_1(P_0 = 0.0)$ to facilitate the input of linear controlled sources.

Two-Dimensional Function:
Where the function is two-dimensional (a function of two branch currents), FV is determined by the following

expression:

$$\begin{aligned} FV &= P_0 + (P_1.FA) + (P_2.FB) + (P_3.FA^2) + (P_4.FA.FB) + \\ &\quad (P_5.FB^2) + (P_6.FA^3) + (P_7.FA^2.FB) + (P_8.FA.FB^2) + (P_9.FB^3) + \cdots \end{aligned} \tag{2}$$

For a two-dimensional polynomial, the controlled current source is a function of two branch currents. To specify a two-dimensional polynomial, set POLY(2) in the controlled source statement.

Three-Dimensional Function:

For a three-dimensional polynomial function with arguments FA, FB, and FC, the function value FV is determined by the following expression:

$$\begin{aligned} FV &= P_0 + (P_1.FA) + (P_2.FB) + (P_3.FC) + (P_4.FA^2) + \\ &\quad (P_5.FA.FB) + (P_6.FA.FC) + (P_7.FB^2) + (P_8.FB.FC) + (P_9.FC^2) + \\ &\quad (P_{10}.FA^3) + (P_{11}.FA^2.FB) + (P_{12}.FA^2.FC) + (P_{13}.FA.FB^2) + \\ &\quad (P_{14}.FA.FB.FC) + (P_{15}.FA.FC^2) + (P_{16}.FB^3) + (P_{17}.FB^2.FC) + \\ &\quad (P_{18}.FB.FC^2) + (P_{19}.FC^3) + (P_{20}.FA^4) + \cdots \end{aligned} \tag{3}$$

Notes:

This is the `F` element in the SPICE compatible netlist.

Version:

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Credits:

Name	Affiliation	Date	Links
Satish Uppathil	NC State University	May 2002	NC STATE UNIVERSITY
svuppath@eos.ncsu.edu			www.ncsu.edu