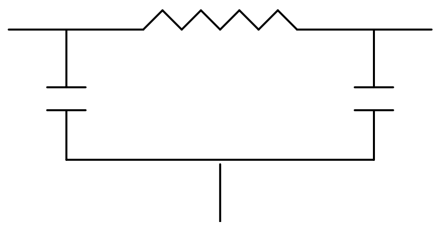
Physical resistor model – poly subtype resistorPhyPoly



Description:
This element implements a semiconductor resistor based on the poly subtype of the Cadence physical resistor model.

Form: resistorPhyPoly: <instance name> n_0 n_1 n_2 <parameter list>

instance name is the model name
n_0 is the positive element terminal,
n_1 is the negative element terminal,
n_2 is the substrate terminal.

Parameters:

Parameter	Type	Default value	Required?
r: Resistance (ohms)	DOUBLE	1E+9	no
coeff0: Constant term of conductance polynomial	DOUBLE	1	no
coeff1: First order coefficient of conductance polynomial	DOUBLE	0	no
coeff2: Second order coefficient of conductance polynomial	DOUBLE	0	no
coeff3: Third order coefficient of conductance polynomial	DOUBLE	0	no
coeff4: Fourth order coefficient of conductance polynomial	DOUBLE	0	no
coeff5: Fifth order coefficient of conductance polynomial	DOUBLE	0	no
polyarg: Polynomial model argument type	BOOLEAN	1 (TRUE)	no
tc1: Linear temperature coefficient of resistor (1/C)	DOUBLE	0	no
tc2: Quadratic temperature coefficient of resistor (1/C^2)	DOUBLE	0	no
tc1c: Linear temperature coefficient of	DOUBLE	0	no

linear capacitor (1/C)			
tc2c: Quadratic temperature coefficient of linear capacitor (1/C^2)	DOUBLE	0	no
tnom: Parameter measurement temperature (K)	DOUBLE	300	no
tdev: Device operating temperature (K)	DOUBLE	300	no
c: Linear capacitance (F)	DOUBLE	0	no

Example:

phyrespoly:r1 1 2 0 r=1000.0 coeff0=1.0 coeff1=0.1 coeff2=0.0 coeff3=0.002 coeff4=0.0
+ coeff5=0.00004 polyarg=0 tc1=0.0 tc2=0.0 tc1c=0.0 tc2c=0.0 tnom=300.0 tdev=300.0
+ c=0.0

Model Documentation:

For polyarg=true:

The controlling voltage for the resistance is:

$$V = ((V(t0) – V(t2)) + (V(t1)-V(t2))) / 2$$

and the resistance is:

$$R(V) = r / (coeff0 + coeff1*V + coeff2*V^2+coeff3*V^3+coeff4*V^4+coeff5*V^5)$$

For polyarg=false:

The controlling voltage for the resistance is:

$$V = V(t0) - V(t1)$$

and the resistance is:

$$R(V) = r / (coeff0 + 1/2*coeff1*V + 1/3*coeff2*V^2 + 1/4*coeff3*V^3 + 1/5*coeff4*V^4 + 1/6*coeff5*V^5)$$

Note that the code does not prevent a negative resistance value; care should be taken in selecting coefficients to ensure that the resulting resistance is positive for all anticipated values of the controlling voltage.

Resistance as a function of temperature is:

$$R(tdev) = R(tnom) * (1 + tc1*(tdev-tnom) + tc2*(tdev-tnom)^2)$$

Capacitance as a function of temperature is:

$$C(tdev) = C(tnom) * (1 + tc1c*(tdev-tnom) + tc2c*(tdev-tnom)^2)$$

See physren for more documentation.

References:

This model is based on a description of the Cadence Spectre physical resistor model found at http://www.uta.edu/ronc/cadence/ResistorModels.pdf.

Sample Netlist:

```
**** resistorPhyPoly dc characteristic ****

* This choice of conductance coefficients should result in positive resistor
* values for Vctrl down to about -5V for polyarg = true or false.

.dc sweep="vsource:vbias" start=-3.0 stop=3.0 step=0.2

resistorPhyPoly:r1 1 2 0 r=1000.0 coeff0=1.0 coeff1=0.1 coeff2=0.0 coeff3=0.002
coeff4=0.0
+ coeff5=0.00004 polyarg=0 tc1=0.0 tc2=0.0 tc1c=0.0 tc2c=0.0 tnom=300.0 tdev=300.0
c=0.0
res:r2 2 0 r = 1000.0
vsource:vbias 1 0  vdc = -3.0

.out write term 1 vt in "poly_dc_vt1.out"
.out write term 2 vt in "poly_dc_vt2.out"

.end
```

Known Bugs:

None.

Credits:

Name	Affiliation	Date	Links
ECE718 Student	NC State University	May 2003	www.ncsu.edu