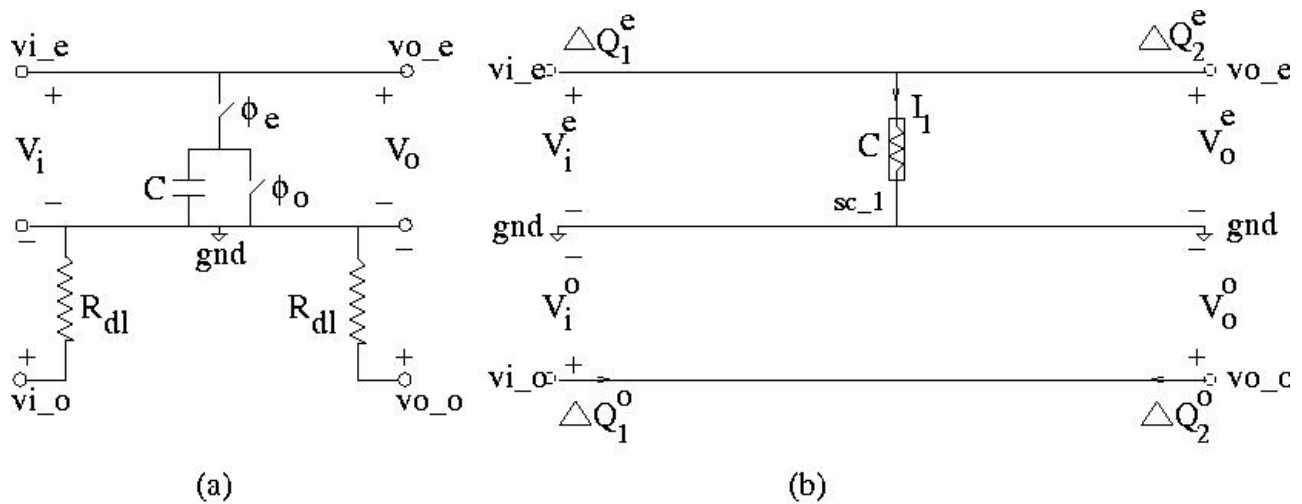


### sc\_ogr\_1.ece (prepared by Rajesh Thakker)

```
mainnodes: vi_e vi_o vo_e vo_o g
auxnodes: aux1
digital_nodes: phi_e phi_o
rparms: ron=1e-3 roff=100M c=10p tc=10n rd=1e24
```

#### General Description:

Open-Circuit Grounded Resistor is one of the common elements found in Switched-capacitor circuits. Its time-domain (a) and frequency-domain (b) circuits are shown below. Ron and Roff are switch "on" and "off" resistances respectively. tc is the clock period. rd is a high value resistance, which is connected to isolated nodes in frequency-domain circuits; this is required to prevent the system matrix from becoming singular.



Open-Circuit Grounded Resistor (OGR)

#### Large-signal:

Time-domain description requires basic elements such as capacitor, resistor and switch. In reality, it is two-port circuit but as the same file contains time-domain and frequency-domain description, number of ports in both should be equal. It is the reason that unused ports/nodes are connected with low-value resistance.

```
ebe name=s_e type=switch5 p=vi_e n=aux1 d_in=phi_e
+ ron=ron roff=roff
ebe name=s_o type=switch5 p=aux1 n=g d_in=phi_o
+ ron=ron roff=roff
ebe name=c1 type=cap p=aux1 n=g
+ c=c v0sv=v0_c1
ebe type=res5 p=vi_o n=vo_o
ebe type=res5 p=vi_o n=g
ebe type=res5 p=vo_o n=g
ebe type=vsrcdc p=vo_e n=vi_e vdc=0
```

**Small-signal:**

It is completely different from time-domain description. It requires calling small signal elements, which are specially written for Switched-capacitor circuits, such as sc\_1, sc\_2, sc\_3 etc. There also unused nodes are connected with high-value resistance. It also needs some basic small-signal elements such as vsrcac (ac source), resistor etc.

```
ebe_ac type=sc_1      p=vi_e  n=g      c=c
ebe_ac type=vsrcac    p=vi_e  n=vo_e  a=0  phi=0
ebe_ac type=vsrcac    p=vi_o  n=vo_o  a=0  phi=0
ebe_ac type=resistor  p=vo_e  n=g      resist=rd
ebe_ac type=resistor  p=vo_o  n=g      resist=rd
ebe_ac type=resistor  p=vi_o  n=g      resist=rd
ebe_ac type=resistor  p=aux1  n=g      resist=rd
```