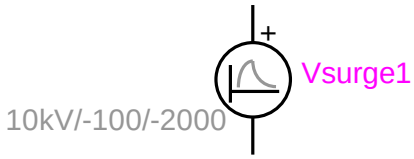
Surge voltage source



Jean Mahseredjian, 4/21/2020 2:37 PM

1 Available versions

The “V surge” device accepts both 1-phase (general) and 3-phase signals. The 3-phase version is the equivalent of 3 decoupled sources (one for each phase).

1.1 When changing phases

- When the device is in its 1-phase state and its signal is changed to 3-phase, but the device is not double-clicked, balanced conditions are assumed and the 3 sources have the 1-phase parameters. The Netlist is generated for the 3-phase version.
- When the device is in its 3-phase state and its signal is changed to 1-phase, but the device is not double-clicked, phase-A quantities are automatically retained for the 1-phase version. The Netlist is generated for the 1-phase version.

1.2 The generic version of “V surge”

1.2.1 Parameters

The voltage source equation is given by:

$$v(t) = V_m \left[e^{\alpha t} - e^{\beta t} \right] \tag{1}$$

The following model parameters are required:

- V_m maximum voltage of the source
- α Alpha coefficient
- β Beta coefficient
- t_{start} start time, if $t < t_{start}$ the source is shorted.
- t_{stop} stop time, if $t > t_{stop}$ the source is shorted. The stop time must be greater than the start time.

The sample simulation waveform shown in Figure 1 is using the data:

$V_m = 10kV$

$\alpha = -100$

$\beta = -2000$

$t_{start} = 1ms$

$t_{stop} = 50ms$

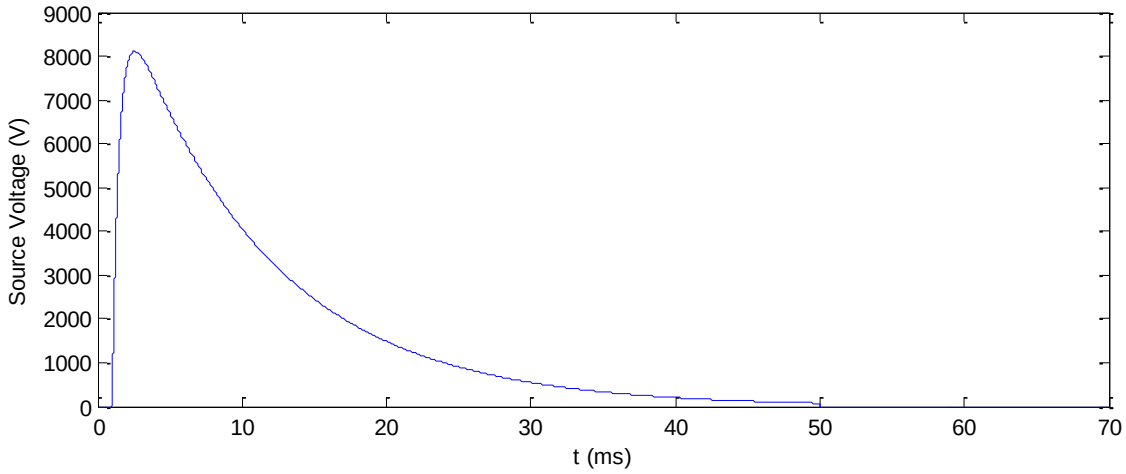


Figure 1 Sample waveform

1.2.2 Netlist format

```
_Vsurge;Vsurge1;2;2;s1,s2,
10kV,-100,-2000,1ms,50ms,?v,?i,?p,
```

Field	Description
_Vsurge	Part name
Vsurge1	Instance name, any name.
2	Total number of pins
2	Number of pins given in this data section
s1	Signal name connected to k-pin (positive), any name
s2	Signal name connected to m-pin, any name
V_m	Maximum voltage
α	Coefficient of the first exponential
β	Coefficient of the second exponential
t_{start}	Start time
t_{stop}	Stop time
?v	Request for voltage scope, sent to scope group vb (branch voltages), optional
?i	Request for current scope, sent to scope group ivs (voltage source currents), optional
?p	Request for power scope, sent to scope group p (branch power), optional

For the 3-phase version, an example of the Netlist gives:

```
_Vsurge;Vsurge1a;2;2;s1a,s2a,
10kV,-100,-2000,1ms,10ms,?v,?i,?p,
_Vsurge;Vsurge1b;2;2;s1b,s2b,
10kV,-100,-2000,1ms,10ms,?v,?i,?p,
```

```
_Vsurge;Vsurge1c;2;2;s1c,s2c,
10kV,-100,-2000,1ms,10ms,?v,?i,?p,
```

EMTPWorks automatically generates 3 separate (decoupled) sources, one per phase. The phase identification character (a, b or c) is automatically appended to the device instance name and signals.

2 Steady-state model

The steady-state model of this device is a short-circuit.

3 Frequency Scan model

The frequency scan model of this device is a short-circuit.

4 Time-domain model

The device is evaluated at each simulation time-point according to its function given by equation (1).
The source is active (not a short-circuit) for $t_{start} \leq t \leq t_{stop}$.