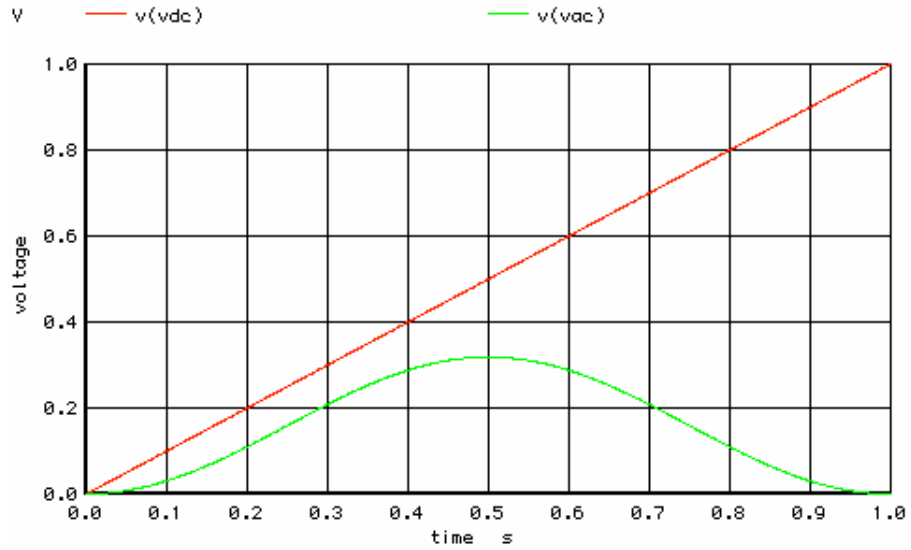


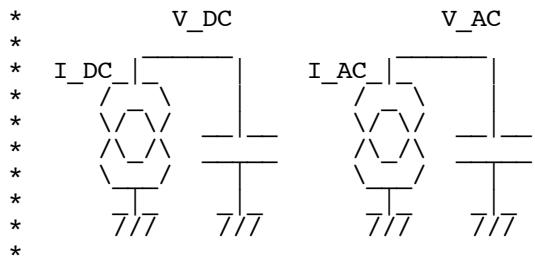
=====Tranlate_between_PM_FM=====



Frequency Modulating any Carrier by a delta frequency Magnitude at the same frequency Rate is effectively....
 Phase Modulating the Carrier at a 1 radian Magnitude at the same frequency Rate

Tranlate_between_PM_FM

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```
*V_SIN# NODE_P NODE_N SIN( V_DC AC_MAG FREQ DELAY FDamp)
*V_PULSE# NODE_P NODE_N PULSE( V_INIT VPULSE TDELAY TRISE TFALL PWIDTH PERIOD )
```

```
.OPTIONS GMIN=1p METHOD=gear ABSTOL=1n TEMP=27 srcsteps = 100 gminsteps = 10
ITL1=400
```

```
.OPTIONS RELTOL=.001 ABSTOL=1n VNTOL=1n ITL4=500
```

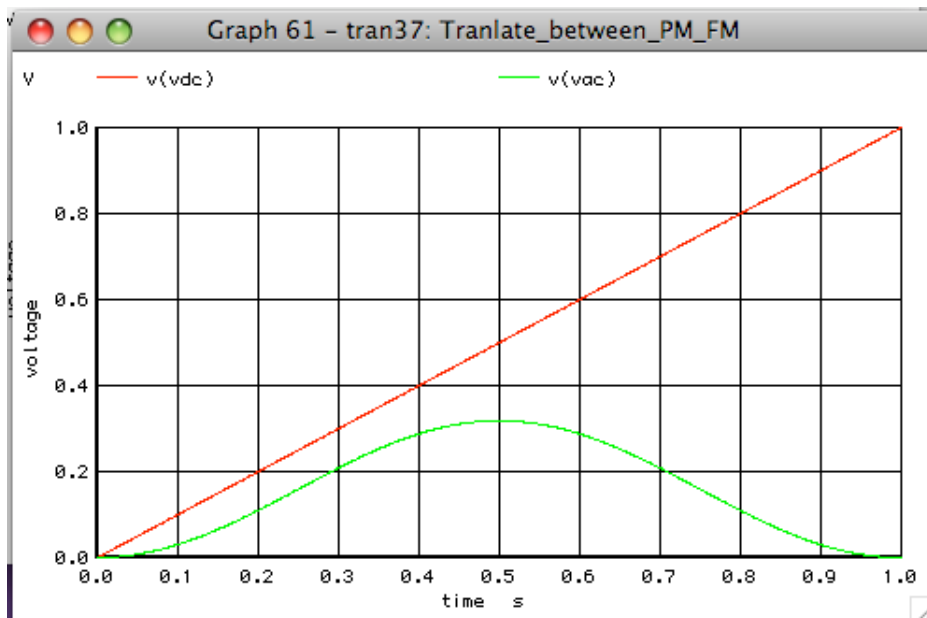
```
*****
IDC 0 VDC DC 0 PULSE( 0 1 1n 1n 1n 10 100 )
CDC VDC 0 1
RDC VDC 0 1000K
IAC 0 VAC DC 0 SIN(0 1 1 1n )
CAC VAC 0 1
RAC VAC 0 1000K
```

```
.control
tran 1m 1
run
set pensize = 1
plot v(vdc) v(vac)
plot v(vac)
.endc
.end
```

1/2PI = 0.15915494309189535 = 0.3183098861837907

=====**END_OF_SPICE**=====

To Covert PDF to plain text click below
<http://www.fileformat.info/convert/doc/pdf2txt.htm>



A little thought experiment...

If a DC current of 1 Amp magnitude is applied to a 1 Farad capacitor, then over 1 second it will swing 1 volt.

If an AC current of 1 Amp magnitude is applied to a 1 Farad capacitor, then over 1 second it will swing $\pm 1/2 \cdot \pi$ volts.

If a 1MHz is increased in frequency by a DC magnitude of 1Hz, then over 1 second it will have 1,000,001 cycles as opposed to 1,000,000 cycles. In other words its phase will be off by $2 \cdot \pi$ radians.

If a 1MHz is modulated in frequency by a 1Hz AC signal also at a 1Hz peak magnitude, then over 1 second its Phase will vary $1/2 \cdot \pi$ less than for the DC frequency offset. In other words it will vary ± 1 radian in phase.

The same applies to a 1GHz signal that is modulated by a 1kHz AC signal which is also at a 1kHz peak magnitude. It will vary in phase by ± 1 radian over 1msec.

So FM modulation using the same frequency for both signal modulation and modulation magnitude is equivalent to Phase modulation at with same signal delayed by 90 degrees at 1 radian modulation magnitude.

Frequency Modulating any Carrier by the same frequency twice

is effectively Phase Modulating the Carrier at a 1 radian Magnitude

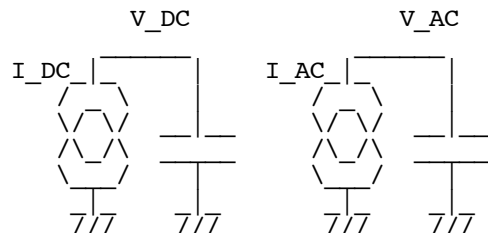
***#1=====WinSpiceVersion=====**

Tranlate_between_PM_FM

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* www.idea2ic.com

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```
*V_SIN#  NODE_P NODE_N          SIN(  V_DC  AC_MAG FREQ  DELAY  FDamp)
*v_PULSE# NODE_P NODE_N        PULSE( VINIT  VPULSE TDELAY TRISE  TFALL  PWIDTH PERIOD )
```

```
.OPTIONS  GMIN=1p          METHOD=gear  ABSTOL=1n  TEMP=27  srcsteps = 100  gminsteps = 10
```

```
ITL1=400
```

```
.OPTIONS  RELTOL=.001  ABSTOL=1n  VNTOL=1n  ITL4=500
```

```
*=====
```

```
IDC      0          VDC      DC      0          PULSE( 0 1 1n 1n 1n 10 100 )
```

```
CDC      VDC      0
```

```
RDC      VDC      0          1000K
```

```
IAC      0          VAC      DC      0          SIN(0 1 1 1n )
```

```
CAC      VAC      0
```

```
RAC      VAC      0          1000K
```

```
.control
```

```
tran      1m      1
```

```
run
```

```
set      pensize = 1
```

```
plot      v(vdc)  v(vac)
```

```
plot      v(vac)
```

```
.endc
```

```
.end
```