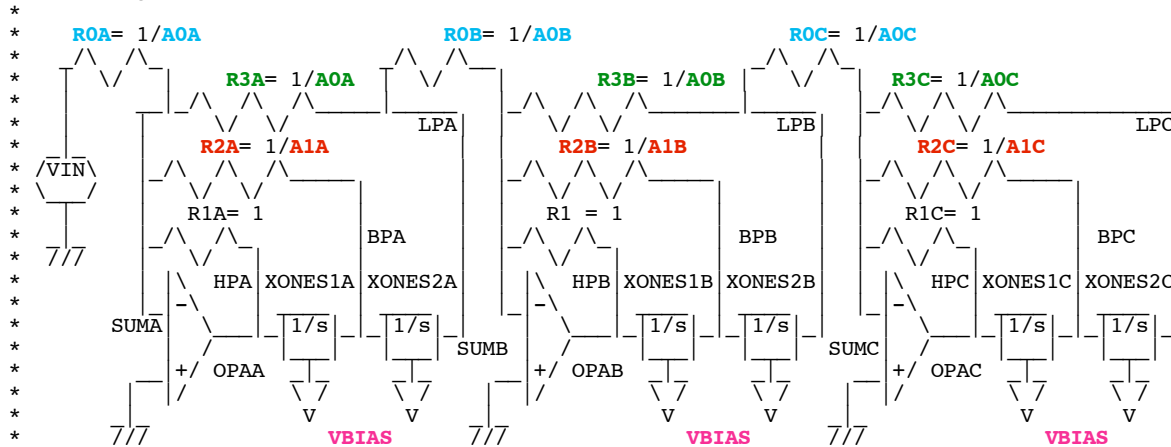


# Butterworth\_6P\_VCF\_FINE

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## Butterworth terms

```

* (s^2 + 0.5176s + 1)(s^2 + 1.4142s + 1)(s^2 + 1.9319s + 1)
.OPTIONS GMIN=1e-18 METHOD=gear srcsteps = 1 gminsteps = 1
=====
V_IN VIN 0 PULSE( -.5 .5 1u 1u 1u 10m 20m ) AC = 1

```

ROA	VIN	SUMA	1	
R1A	SUMA	HPA	1	
R2A	SUMA	BPA	1.9319	
R3A	SUMA	LPA	1	
XOPA1A	SUMA	HPA	OPA	
XONES1A	HPA	BPA	VBIAS	ONE_S
XONES2A	BPA	LPA	VBIAS	ONE_S
ROB	LPA	SUMB	1	
R1B	SUMB	HPB	1	
R2B	SUMB	BPB	.707	
R3B	SUMB	LPB	1	
XOPA1B	SUMB	HPB	OPA	
XONES1B	HPB	BPB	VBIAS	ONE_S
XONES2B	BPB	LPB	VBIAS	ONE_S
ROC	LPB	SUMC	1	
R1C	SUMC	HPC	1	
R2C	SUMC	BPC	.5176	
R3C	SUMC	LPC	1	
XOPA1C	SUMC	HPC	OPA	
XONES1C	HPC	BPC	VBIAS	ONE_S
XONES2C	BPC	LPC	VBIAS	ONE_S

```

E_INVERT OUT0 0 LPC 0 -1
VBIAS VBIAS 0 DC .4

```

\*#0 =====A Bessel is Best for Low Phase Distortion=====

```

.control
set pensize = 2
*#1 =====SET VCF VBIAS TO 400m=====
set outfile0 = "Butterworth_6P_VCF_400m.txt"
tran 1m 40m 0 10m
run
plot vin out0 title Vbias_600m

let saveData = 1
if (saveData>0)
"VpwlA OUTA 0 PWL(" >$outfile0
let NoOfTime = length(time)
echo "Number of points is $&NoOfTime "
let n = 0
repeat $&NoOfTime
let timestep = time[n] - time[n-1]
let timme = time[n]
let vout = out0[n]
if (timestep > 1u)
"+ $&timme $&vout " >> $outfile0
let n = n+1
"+ )" >>$outfile0
ac dec 50 1 10000
run
plot db(out0) ylimit -20 0 title Vbias_400m

```

```

*#2 =====SET_VCF_VBIAS_TO_200m=====
alter      vbias dc = .2
set        outfile1 = "Butterworth_6P_VCF_200m.txt"
tran       1m      40m      0      10m
run
plot       vin out0 title Vbias_200m

let        saveData = 1
if         (saveData>0)
echo      "VpwlB OUTB 0 PWL(" >$outfile1
let       NoOfTime = length(time)
echo      "Number of points is $&NoOfTime "
let       n = 1
repeat    $&NoOfTime
let       timestep = time[n] - time[n-1]
let       timme = time[n]
let       vout = out0[n]
if        (timestep > 1u)
echo      "+ $&timme $&vout " >> $outfile1
endif
let       n = n+1
end
echo      "+ )" >>$outfile1
endif
ac        dec 50 1 10000
run
plot      db(out0) ylimit -20 0 title Vbias_200m

*#3 =====SET_VCF_VBIAS_TO_100m=====
alter      vbias dc = .1
set        outfile2 = "Butterworth_6P_VCF_100m.txt"
tran       1m      40m      0      10m
run
plot       vin out0 title Vbias_100m

let        saveData = 1
if         (saveData>0)
echo      "VpwlC OUTC 0 PWL(" >$outfile2
let       NoOfTime = length(time)
echo      "Number of points is $&NoOfTime "
let       n = 0
repeat    $&NoOfTime
let       timestep = time[n] - time[n-1]
let       timme = time[n]
let       vout = out0[n]
if        (timestep > 1u)
echo      "+ $&timme $&vout " >> $outfile2
endif
let       n = n+1
end
echo      "+ )" >>$outfile2
endif
ac        dec 50 1 10000
run
plot      db(out0) ylimit -20 0 title Vbias_100m

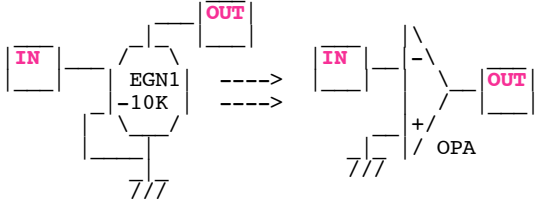
.endc

```

```

=====OP_AMP=====
.SUBCKT OPA IN OUT 0 -10k
EGN1 OUT 0 IN 0
.ends
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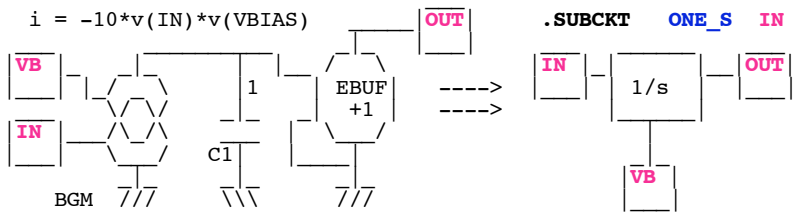
```



```

=====GM_C=====
.SUBCKT ONE_S IN OUT VB
BGM 1 0 i = -10*v(IN)*v(VB)
C1 1 0 1m
EBUF OUT 0 1
.ends
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```



.end

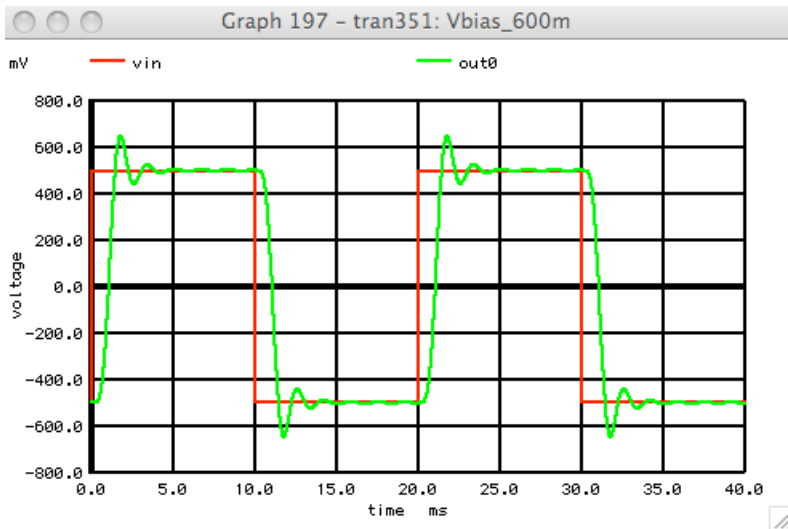
=====END\_OF\_SPICE=====

The Phase Distortion of the Butterworth needs to be looked at with more resolution.

```

*#1 =====SET_VCF_VBIAS_TO_400m=====
set outfile0 = "Bessel_6P_VCF_1.txt"
VBIAS VBIAS 0 DC .4

```

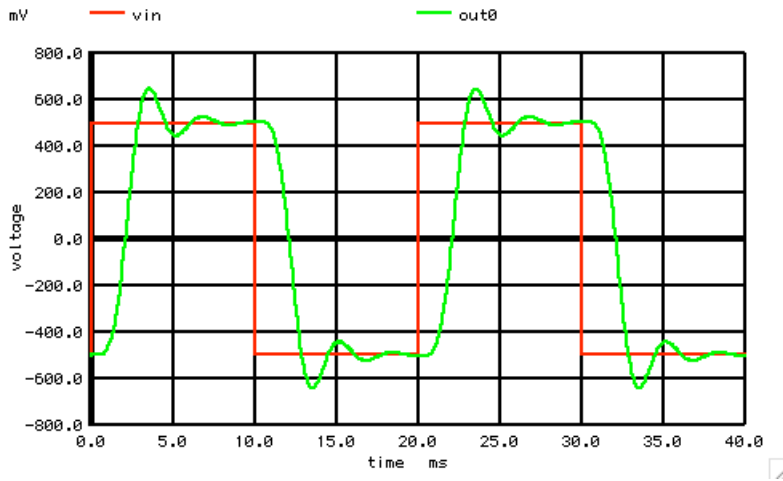


```

*#2 =====SET_VCF_VBIAS_TO_200m=====
alter vbias dc = .2
set outfile1 = "Bessel_6P_VCF_200m.txt"

```

Graph 199 - tran353: Vbias\_200m



```
*#3 =====SET VCF_VBIAS_TO_100m=====  
alter      vbias dc = .1  
set        outfile2 =      "Bessel_6P_VCF_100m.txt"
```

Graph 201 - tran355: Vbias\_100m

