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RANGE GATE RESPONSE FOR INTERIM SYSTEM.(U)
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RFSS

# RANGE GATE RESPONSE FOR INTERIM SYSTEM

TECH NOTE 105-031

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# RANGE GATE RESPONSE FOR INTERIM SYSTEM

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**Summary**

It has often been assumed that the range gate response in the receiver is triangular for the interim system being simulated on the RFSS. In this memo we compute a more realistic response that is based on the finite IF bandwidth of 20 MHz. We also provide a listing of a subroutine that can be used in the extended target simulation program to compute the range gate response.

**Results**

The interim system is based on a short pulse of 125 nsec in length. If the spectrum is not bandlimited, its voltage will be

$$X(f) = \frac{\sin \pi fT}{\pi fT}$$

where T = 125 nsec. The first zero will occur at $f_o$ = 8 MHz. We will assume that the spectrum is bandlimited, where the shape of the bandpass filter (voltage) is given by

$$H(f) = 1 \quad , |f| \leq 1/T$$

$$= \cos[\pi(fT-1)], \quad 1/T < |f| \leq 1.5/T$$

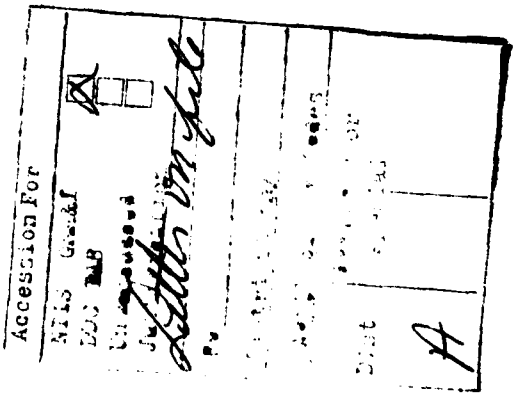
$$= 0 \quad , 1.5/T < |f|$$

Note that the half-power width of this filter is B = 2.5/T, which is 20 MHz for the interim system parameters. The transmitted signal spectrum (voltage) is thus given by

$$Y(f) = X(f)H(f)$$

which is plotted in Figure 1.





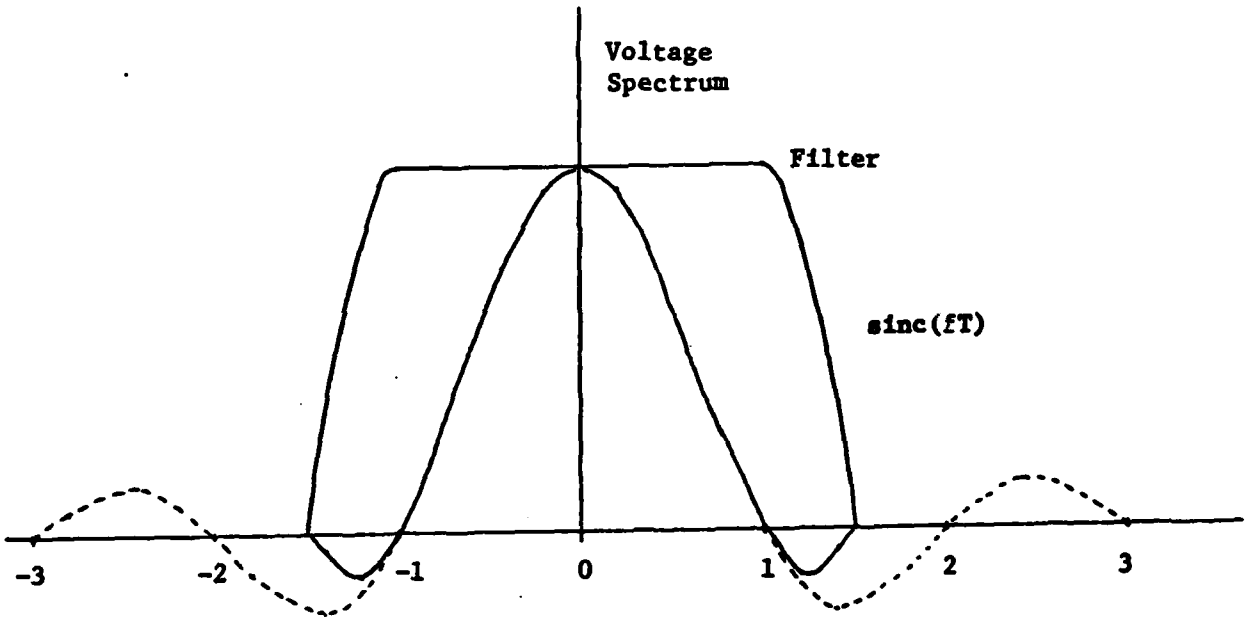



Figure 1. Signal Spectrum.

We will assume that the receiver is matched to the transmitted pulse, y(t), which is the Fourier transform of Y(f). The receiver is the auto-correlation function of y(t), where its spectrum is given by

$$Z(f) = |Y(f)|^2$$

Thus the receiver response $\chi(\tau)$ is the Fourier transform of Z(f). In Figure 2 we show the response for the interim system parameters. Samples of $\chi(t)$ at intervals of 0.1/T are shown below.

| $\tau/T$ | $z(\tau)$ |
|---|---|
| 0 | 1.00000 |
| 0.1 | .98104 |
| 0.2 | .92193 |
| 0.3 | .81903 |
| 0.4 | .67431 |
| 0.5 | .50112 |
| 0.6 | .32385 |
| 0.7 | .17071 |
| 0.8 | .06308 |
| 0.9 | .00731 |
| 1.0 | -.00651 |
| 1.1 | .00182 |
| 1.2 | .01262 |
| 1.3 | .01458 |
| 1.4 | .00713 |
| 1.5 | -.00313 |
| 1.6 | -.00898 |
| 1.7 | -.00762 |

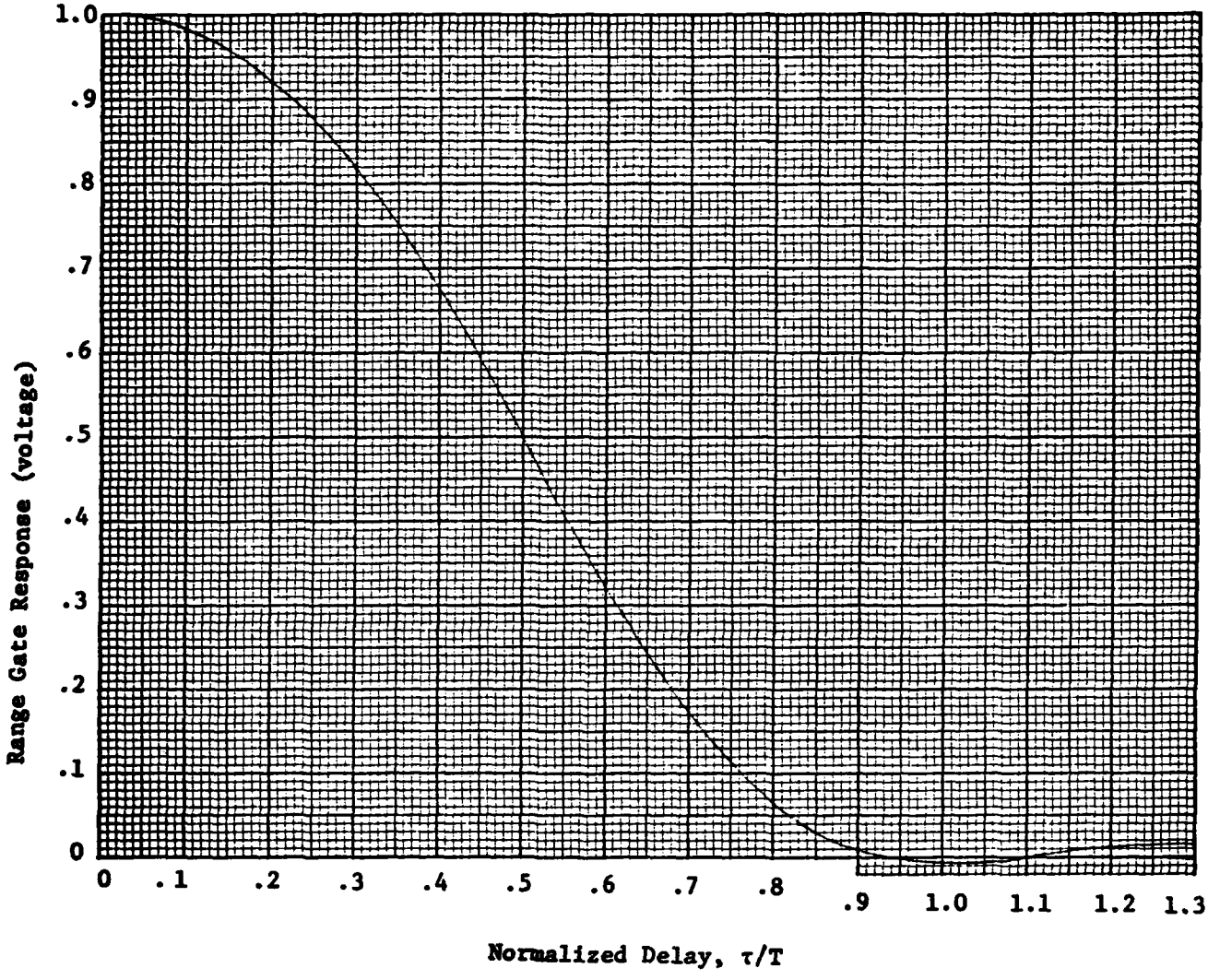



**Figure 2. Range Gate Response.**

Computer Subroutine

```
      FUNCTION CHI(P)
C
C RANGE GATE RESPONSE.  THE ARGUMENT P IS THE RANGE MISMATCH NORMALIZED
C TO THE RECEIVER GATE SPACING.  INTERPOLATION IS USED ON THE SAMPLES
C STORED IN THE A-ARRAY, WHERE THE SPACING IS 0.1 UNIT.
C
C THE RESIDUAL ERROR IN THE INTERPOLATION IS LESS THAN .0003
C
C P MUST BE LESS THAN 1.5 IN MAGNITUDE.
C
C THE SAMPLES ARE OF THE RESPONSE DERIVED IN MRI REPORT 149-4.
C
      DIMENSION A(18)
      DATA A/1.00000, .98104, .92193, .81903, .67431, .50112, .32385,
     1       .17071, .06308, .00731,-.00651, .00182, .01262, .01458,
     2       .00713,-.00313,-.00898,-.00762 /
      H=10.*ABS(P)
      IF(H.GT.15.) STOP 55
      I=H
      H=H-I
      IP1=I+1
      IP2=I+2
      IP3=I+3
      IF(I.LE.0) I=2
      CHI=-.166667*H*(H-1.)*(H-2.)*A(I)+.5*(H**2-1.)*(H-2.)*A(IP1)
     1    -.5*H*(H+1.)*(H-2.)*A(IP2)+.166667*H*(H**2-1.)*A(IP3)
      RETURN
      END
```