Design and Construction of Extracting Circuit

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Abstract

The principle of radar echo analysis for extracting the Doppler signal of moving echoes (eliminating fixed echoes) is based on the use of a sampler associated with a hold capacitor followed by a band-pass filter.

The filter cut-off frequencies are chosen as a function of the types of targets to be detected. The fast filter has a pass-band from 190 Hz to 1800 Hz. These frequencies correspond to Fast targets having radial velocities of between approximately 10 Kph and 200 Kph.

The slow filter has a pass-band from 60 Hz to 230 Hz. these frequencies corresponding to slower targets. Whose radial velocities lay between approximately 3.5 Kph and 13 Kph. The

الخلاصـــــة

أن مبدأ تحليل واستخلاص أشارة دوبلر للأهداف المتحركة (حذف الأهداف الثابتة) يبنى على استخدام دوائر (sampler) المقترنة بدوائر المرشح (band- pass filter).
اختيرت حدود القطع للترددات في المرشحات اعتماداً على أنواع الأهداف التي تكشف. المرشح السريع يمتد من (190 Hz -1800 Hz) هذه الترددات تعالج الأهداف السريعة التي تتراوح سرعتها من (10 Kph -200 Kph).
المرشح البطيء يمتد من (60 Hz -230 Hz) هذه الترددات تطابق الأهداف البطيئة والتي تتراوح سرعتها من (3.5 Kph -13 Kph).

1. Introduction

An anglo filter like that Fig (1) can be represented by the equation [1].

$$\frac{V_o(s)}{V_i(s)} = H(s) = \frac{N(s)}{D(s)} \quad \text{..... (1)}$$

where:

$V_i(s)$ and $V_o(s)$: are the laplace transforms of the input and output voltages
$V_i(t)$, H(s): is the transfer function, and
N(s) and D(s): are polynomials in $s(=\sigma + jw)$.

The loss (or attenuation) of the filter in decibels is defined by:

$$A(w) = 20\log\left|\frac{V_i(jw)}{V_o(jw)}\right| = 20\log\frac{1}{|H(jw)|} = 10\log L(w^2) \quad \text{..... (2)}$$

where:

$$L(w^2) = \frac{1}{H(jw)H(-jw)} \quad \text{..... (3)}$$

The plot of A(w) versus w is the loss chrematistic. The phase shift and group delay of the filter are given by:

$$\theta(w) = \arg H(jw) \quad \text{and} \quad \tau = -\frac{d\theta(w)}{dw} \quad \text{..... (4)}$$

Respectively. Their plots versus w are the phase delay characteristics. With *w=s/j* in eq.(3) the function:

$$L(-s^2) = \frac{D(s)D(-s)}{N(s)N(-s)}$$

Can be formed as shown in **Fig.(1)** shown below:

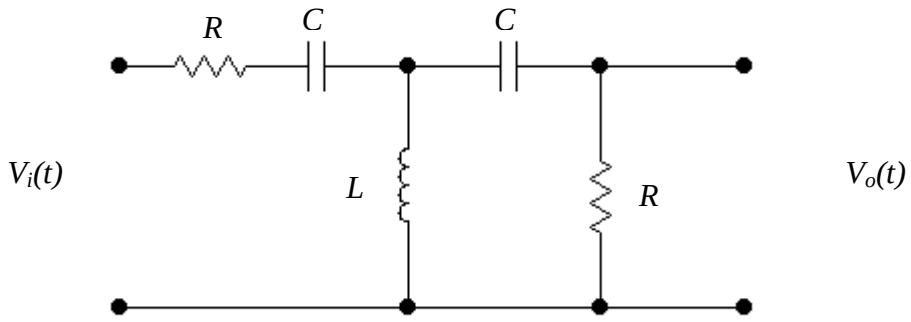


Figure (1) Analog filter

2. Selector Module

The diagrams in **Fig.(2)** show how a moving echo, whose amplitude varies from one. Recurrence to the next, produces a Doppler-frequency signal following sampling at this same recurrence rate and filtering as shown **Fig.(2-a)**. On the other hand, a fixed echo, after sampling a DC signal (A). After band-pass filtering, the DC component disappears, and the output signal is Zero as shown in **Fig.(2-b)**.

At each radar pulse, the video-frequency signal is fed to capacitor C1, which charges to the peak value [1]. At the end of the pulse, switch Q1 opens, and the capacitor remains charged until the next analysis pulse appears as shown in **Fig.(3)**.

The filter cut-off frequencies are chosen as a function of the types of targets to be detected. The fast filter has a pass-band from 190 Hz to 1800 Hz. These frequencies correspond to Fast targets having radial velocities of between approximately 10 Kph and 200 Kph [2].

The slow filter has a pass-band from 60 Hz to 230 Hz. these frequencies corresponding to slower targets. Whose radial velocities lay between approximately 3.5 Kph and 13 Kph. The electrical characteristics of these filters are shown in **Fig.(4)**.

Depending on the nature of the target, the filter is selected by applying the power supply voltage $\pm V_R$ or $\pm V_L$ to the operational amplifier of the selected filter [3].

After filtering, the Doppler signal is applied to a summing amplifier, whose gain adjusted by the potentiometer [4,5].

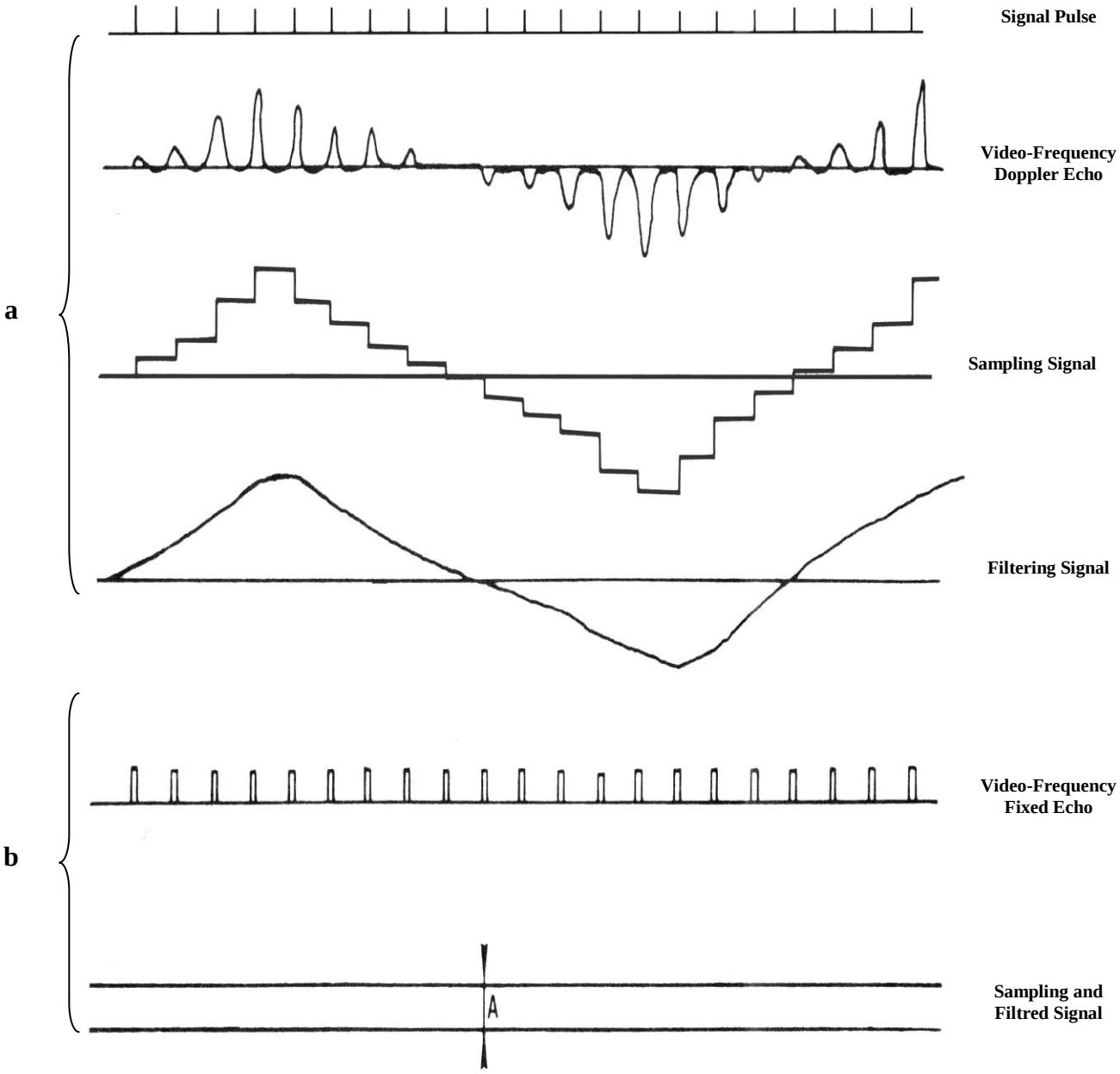
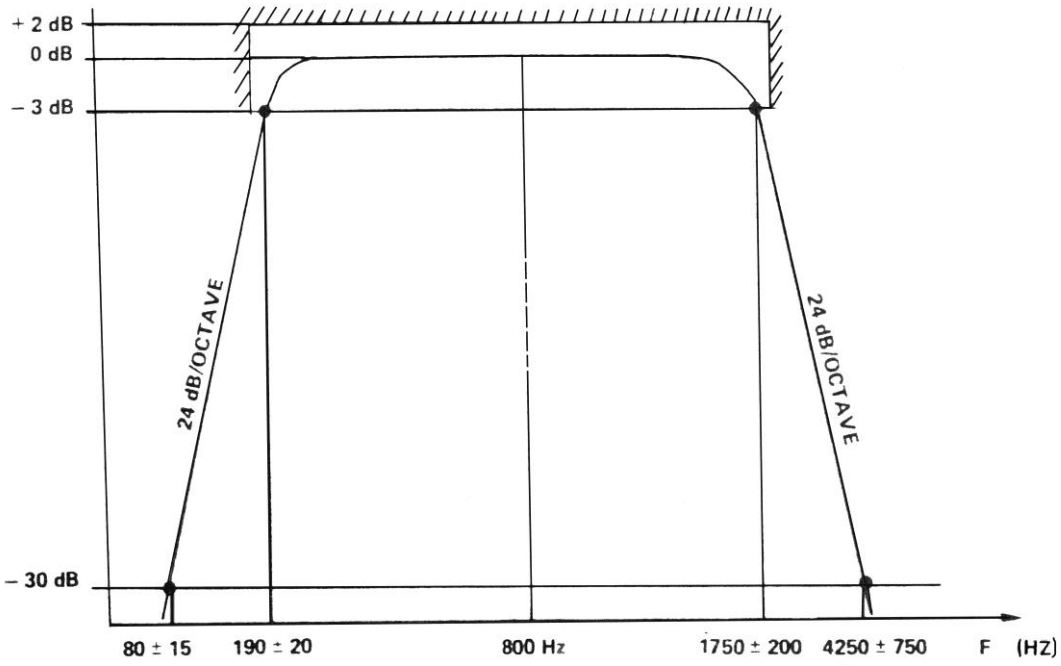


Figure (2) a. Recurrence rate and filtering b. output signal

FAST – TARCET FILTER



SLOW – TARCET FILTER

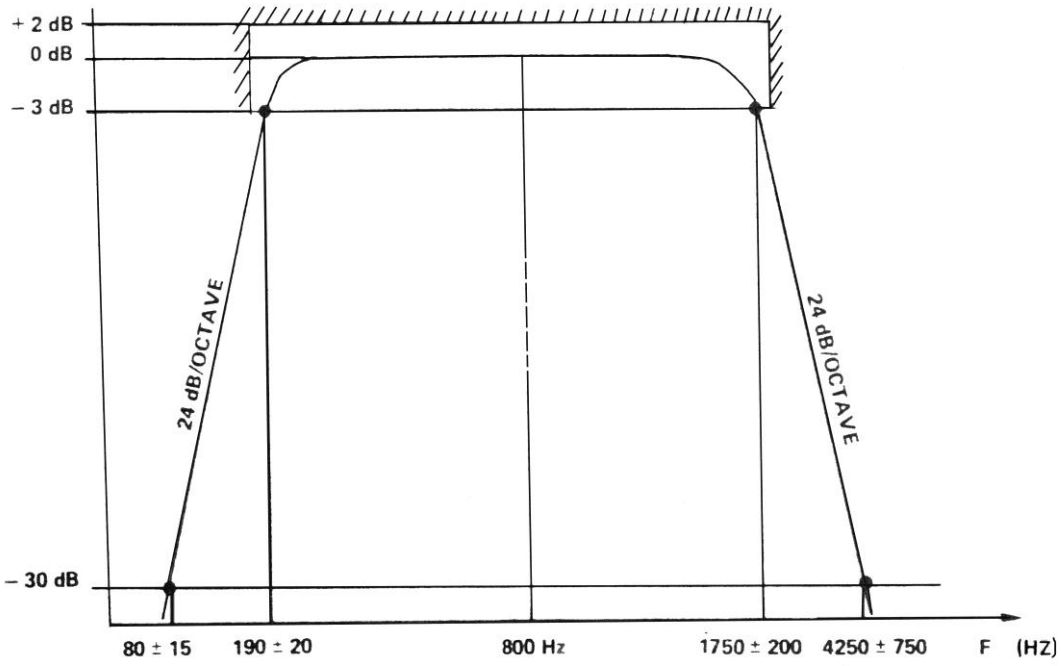


Figure (4) The electrical characteristics of the filter

3. Conclusions

This paper is concerned with design and construction of extracting circuit, based on using sampler associated with a hold capacitor followed by a band-pass filter.

The main object of the design is to eliminating fixed echoes. To conclude the objectives of this work, the following points are presented

1. MosFET transistor in sampler circuit more suitable compared to another electronics circuit.
2. Using highly accurately components in design and construction of band-pass filter.

4. References

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