

Active Tunable Filters Based on C-Negatrons

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Abstract – Design and research results of active filters on C-negatron are shown in the paper. The main feature of the filters is a large value of the frequency tuning coefficient.

Keywords – active filter, negative capacitance, C-negatron.

I. INTRODUCTION

Active filters are widely used in radiodevices and radio-measuring equipment. However, the most famous circuits have electrically controlled cutoff frequency in a narrow frequency band (the frequency tuning coefficient is up to 10 times). Such restriction can be overcome by using a transistor structure with negative resistance [1, 2] or C-negatron.

II. DEVELOPMENT AND RESEARCH

C-negatron is a device with negative differential capacitance. C-negatron can be realized with physical effects in semiconductor structures [3] or on impedance converter circuits, particularly on field effect or bipolar transistors, operational amplifiers, current conveyors.

The paper presents active low-pass filter on C-negatron of N-type, equivalent circuit of which consists of negative differential capacitance and active negative differential resistance (C-N) (Fig. 1).

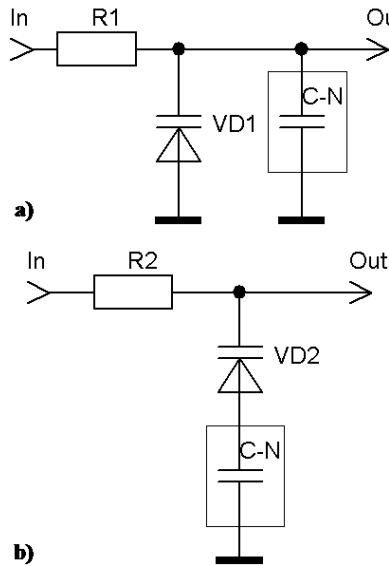


Fig. 1. Schemes of active low-pass filters with parallel (a) and sequential (b) included C-negatron

The frequency response function curves of the low-pass filter on the varactor (a) and on parallel C-negatron (b) for control voltage values from 0 to 9 V with step of 1 V are shown in Fig. 2. The filter on C-negatron has the frequency

tuning coefficient up to 39.4 times more than the filter without it. The filter on C-negatron has also the signal attenuation in the passband equals 0 dB while the filter without it has the signal attenuation in the passband equals 6 dB.

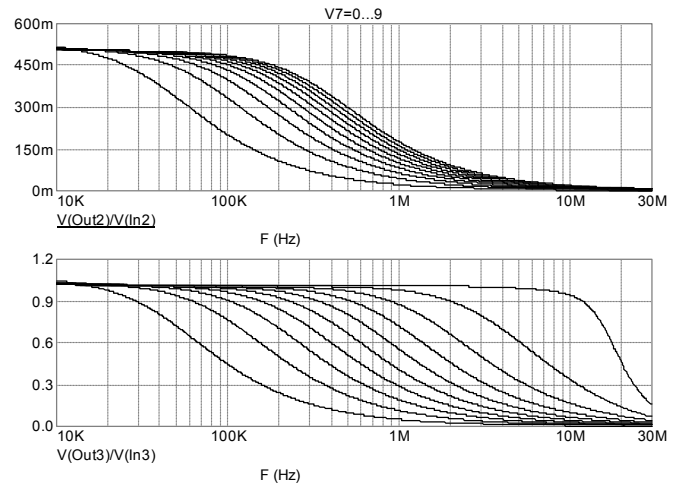


Fig. 2. Frequency response function of the low-pass filters on varactor (a) and on parallel C-negatron

The described approach can be used to design others filters types as high pass filter, band-stop and band-pass filters.

III. CONCLUSION

The proposed active filters on C-negatrons have the frequency tuning coefficient value up to 315 times. Also the filters have signal attenuation 0 dB or a few decibels amplification.

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