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Design of Active HVDC Filter to Improve Efficiency in Photovoltaic Systems

First Author : Farnam soleimani
Email :Farnam.soleimani@gmail.com

Abstract
In this research, we designed a circuit for active volt-amp filtering at high frequency in the frequency range of 10-100MHz. This model of circuits has transistor structure that have high active voltage range in the DC range. In the structure of this circuit, the second-class differential cascode technique is designed with a mirror-style circuit. This circuit, with a mirror-shaped circuit structure, separates the positive and negative circuit charge values in DC voltage and prevents polarization interference, which will weaken the voltage and inefficiency of the circuit. In these circuits, most of the two diode and transistor structures are designed in combination. Another advantage of this circuit is the transistor structure, which, by changing the value of W / L, determines the value of the analysis of the output circuit diagrams and, in terms of the active filter structures, improves the analytical value and increases the circuit operation. These types of circuits are used in the structure of photovoltaic systems and wind-converter systems at 50-240 DCV voltages. These photovoltaic systems have the most efficient photovoltaic structure. Thus, the photovoltaic system transmits direct sunlight to the voltage and transmits it to the Vdc mode at the output of the system. This filter with active transistor structure improves the efficiency of the high voltage level of DC and also low voltage and voltage distortion in voltage rectifier. It also has a low voltage level in MHz; this bandwidth will improve the circuit's floating voltage and weaken and reduce the delay time in the voltage transmission circuit to increase the efficiency of the circuit. Circuit design is designed using ADS software using CMOS 0.18um transistor technology.

Keywords: “Active Filter”, “High Voltage DC” , “CMOS” , “F MHz” , “Distortion”

Introduction

Today, active filter circuits are used in power supply systems and DC voltage transfer systems in photovoltaic systems. In the past, the circuits are connected to the transformer, which are blocked by separate rectifier diagrams and have capacitive filters. But there are many disadvantages that can be noted for the disadvantages of large and heavy, relatively high cost and high ripples; these models were designed in 1830 [1]. Initial power supplies used elemental elements such as BJT, which results in lower efficiency of less than about 68%, which is no longer used. Hence, the industry uses CMOS and MOSFT transistor technology, which has favorable characteristics in the field of photovoltaic system resources. The main disadvantage of this use of this transistor in industrial power supplies is the application of a frequency of 1MHz, which is greater than the nominal frequency of the transformers and circuits of that time, and they should use capacitive filter reducers to smooth the voltage from these transistor circuits [2]. Given the limitations of DC machines, it was clear that further development of HVDC needed better quality models than those of these machines, which is why some developed another version of the converters. In 1932, Marx invented in Germany airborne converters that arched scaling between two similar electrodes, alternating current could be converted to direct current, but this kind of converter was a problem such as low electrodes life, a relatively high voltage drop (V500), and also loss of power Extremely high for arc, and for cooling air and extinguishing air, it had about 3% transient power. In 1930, for the first auxiliary electrodes, these diodes were capable of inverter mode, and in the following years, DC-converter exchanges were equipped with these diodes [3]. By examining HVDC systems, we see that in some cases, direct-current energy transfer is the only remedy available, and technical problems do not allow the use of alternating current for this purpose. In some other HVDC systems, the superiority of the DC transmission in this case has led to the selection of the HVDC relative to AC transmission. Given that the DC transmission can be done with two or more conductors (instead of three conductors in AC). Transmission of a large amount of power over long distances (more than 800 km) is more cost effective than DC in comparison with AC [4]. In some cases, other parameters such as improved stability, short-circuit preservation, and more control are also considered, which, in spite of the equal cost of DC, is preferred over AC. Increasing advances in the production of semiconductor devices for higher power at cheaper prices have made it much easier to use the direct flow transfer [5].

In this study, we design the HVDC active transistor circuit design with a transistor structure, which checks the circuit in the parametric output quantities relative to the voltage and frequency applied to the circuit.

Active filter function analysis

Due to the diverse designs in the Active Filter Circuit, it is designed with a variety of orbits for different purposes. Due to the limitations of using inactive filters, the filter elements can be adjusted to increase the cost of making filters in passive filters. Inactive filter by interconnecting inactive elements with low impedance (at harmonic frequency), parallel to the harmonic, eliminates the voltage from the DC transmission line. The ratio of the output voltage to the circuit network impedance is calculated in Equation 1. This equation represents the voltage level relative to the impedances of the Zd transmission line and the Zshunt impedance of the filtering network, whose harmonic frequency is calculated. The band passes the filter in the frequencies that are set to the amplitude and at this frequency $\left|Z_f\right| = \sqrt{2R}$ the resistance impedance is at 045 ± 0 degrees, the resonance frequency in equation 2 and the frequency deviation in equation 3 and for the inductive or capacitive reactance in time $\omega = \omega_n$ in equation 4 and the coefficient The quality of the filter is in equation 5. For a small variation of the impedance frequency $(\delta \prec\prec 1)$ in Equations 6 and 7, its conditions are obtained in equation 8 for the values of the admittance, deductance and susceptibility values [5]. Due to its active filter and its transistor structure, its function is expressed in the system as follows:

- Phase detection and harmonic size of the two-terminal voltage transmission line.
- Proper I / V performance in harmonic frequencies, to neutralize the transmission line voltage harmonics.

The expression of the filtered protocol protocols in the demand for the detection of the size and phase of the current harmonics on the line and the injection of appropriate flows at these frequencies. With this injection process, the harmonic flow is expected to be neutralized. The harmonic of the current entering the AC network is essentially equal to zero. Injection flow is done in two ways: direct and indirect, economically, the direct method is unusable, and therefore the flow of the injection is indirectly used to AC network. DC power converters at both ends produce flow hammers. These harmonics enter the AC system. On the DC side, they generate voltage harmonics [6] [7].

$$V_{th} = V_{conv.h}\left[\frac{Z_{shunt}(h)}{Z_{shunt}(h) + Z_d(h)}\right]$$

$$\omega_n = \frac{1}{\sqrt{LC}}$$

$$\delta = \frac{\omega - \omega_n}{\omega_n}$$

$$X_0 = \omega_n.L = \frac{1}{\omega_n c} = \sqrt{\frac{L}{C}}$$

$$Q = \frac{X_0}{R}$$

$$Z_{hf} \cong R\left(1 + 2j\,\delta Q\right) = X_o\left(Q^{-1} + j\,2\delta\right)$$

$$|Z_{hf}| \cong R\left(1 + 4\delta^2 Q^2\right)^{\frac{1}{2}} = X_o\left(Q^{-2} + 4\delta^2\right)^{\frac{1}{2}}$$

$$|G_{hf}| \cong \frac{2\delta Q}{R\left(1 + 4\delta^2 Q^2\right)} = \frac{2\delta Q^2}{X_0\left(1 + 4\delta^2 Q^2\right)}$$

Simulation and measurement

In this study, the design and analysis of an active HVDC active circuit in a 10-100 MHz frequency band are being developed, using the design of this circuit, we can provide capabilities that are innovative as compared with other researches. The proposed circuit is a model of active circuit diagram design that has multi-stage tensist and multi-class voltage filtering. This circuit is designed with a Cascode technique in the 5th differential and has RC and RLC filters parallel. The model of the circuit is mirrored in such a way that in the positive and negative polarities and also in the mode of the digital circuit in the systems that apply the signal to the circuit and the circuit with a DC voltage level, it is referred to as the signal dispersion in DC, it is created. By creating a spatial model, the circuit makes the circuit operating in the signal's fashion and the voltage level at each outlet of the transistor has a very low noise and high efficiency, which reduces the floating signal's weakening in the circuit. This design also allows the circuit to be connected to other power supply circuits, such as the voltage rectifier block and the voltage applied to this circuit, as well as a voltage regulator. Using a transistor placed in the positive and negative voltage path, it has the role of a diode, which causes the voltage level to be completely recalibrated and filtered in the output voltage of the DC voltage. Also, transistors designed at the beginning and end of the circuit are cascode, the role of the voltage-circuit mode in

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effective efficiency creates a very low level of DC voltage, which results in a significant reduction in the output voltage output. Referring to the description of the active filter circuit, see the schematic of the proposed circuit in Fig. 1. The signal decomposition diagram is measured in different quantities relative to the return and return signal and frequency isolation, Fig. 2 shows the signal dispersion diagram of the proposed circuit. In Fig. 3, the stability diagram of the circuit is determined by the voltage level and the signal in the circuit. The value of the effective efficiency level of the circuit relative to the voltage and signal in the active filter is calculated to be the value of the voltage gain, which determines this value of the output power of the circuit relative to the voltage and high circuit efficiency; Fig. 4 shows the proposed voltage filter voltage Fig. 5 also shows the diagram of the impedance level and the input of the circuit. You see the value of the output signal spectrum relative to the circuit voltage in Fig. 6; this value is based on the amount of harmonics of the voltage spectrum on the filter output signal. The value of the voltage measured relative to the signal amplitude is shown in Fig. This circuit measures the voltage level of the circuit output range

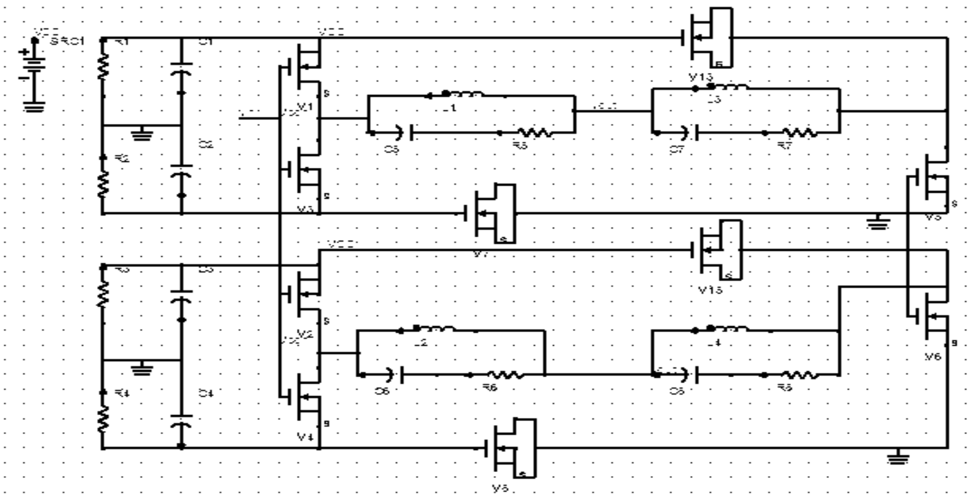

Figure 1: Schematic of proposed circuit

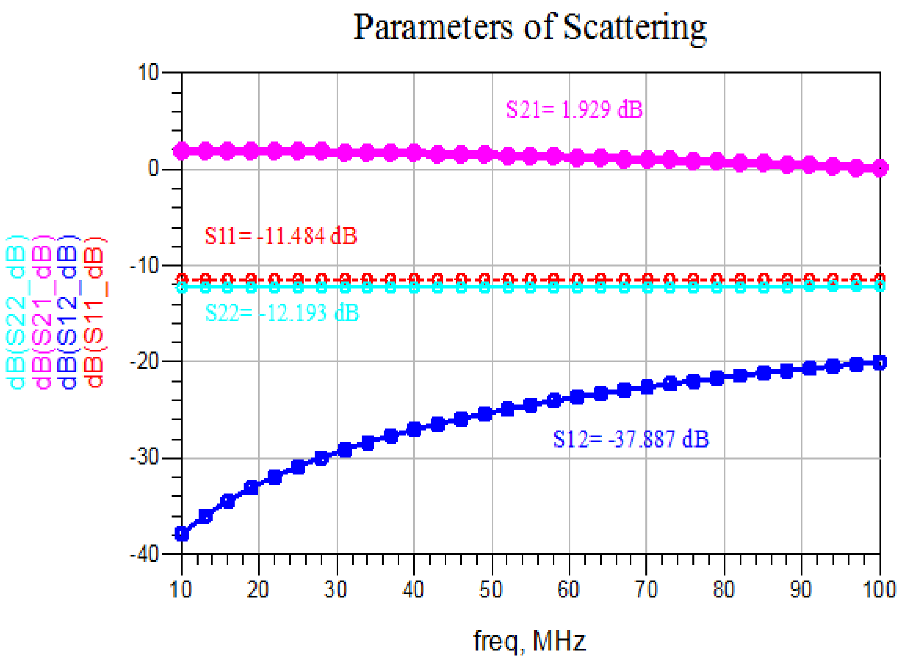

Figure 2: Dispersion Parameters Charts

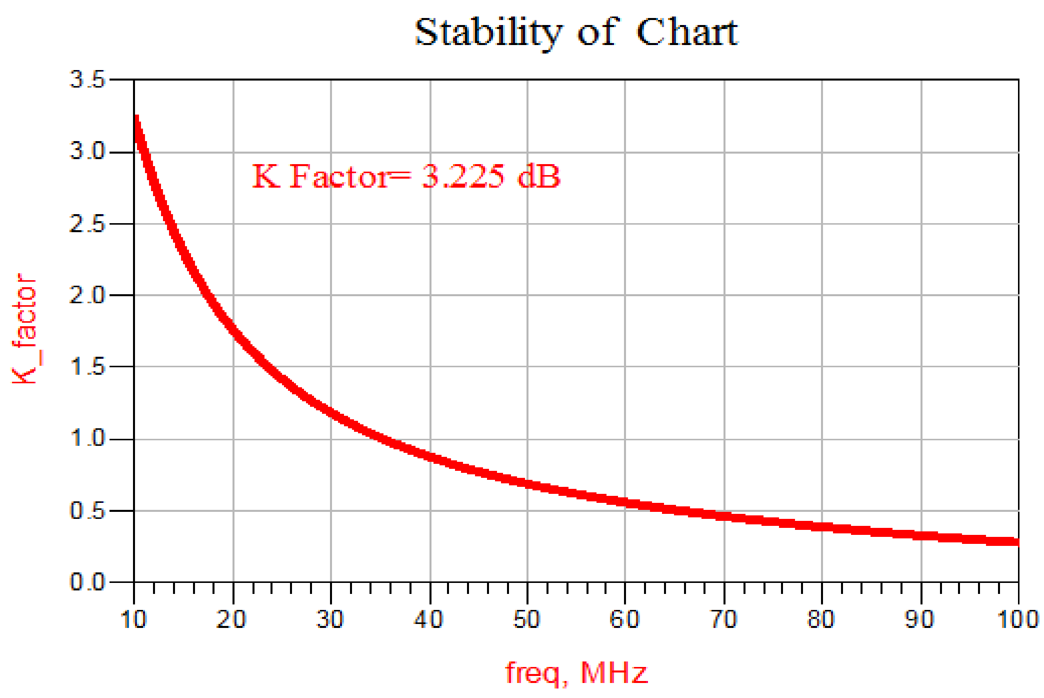

Figure 3: Proportional filter circuit stability diagram

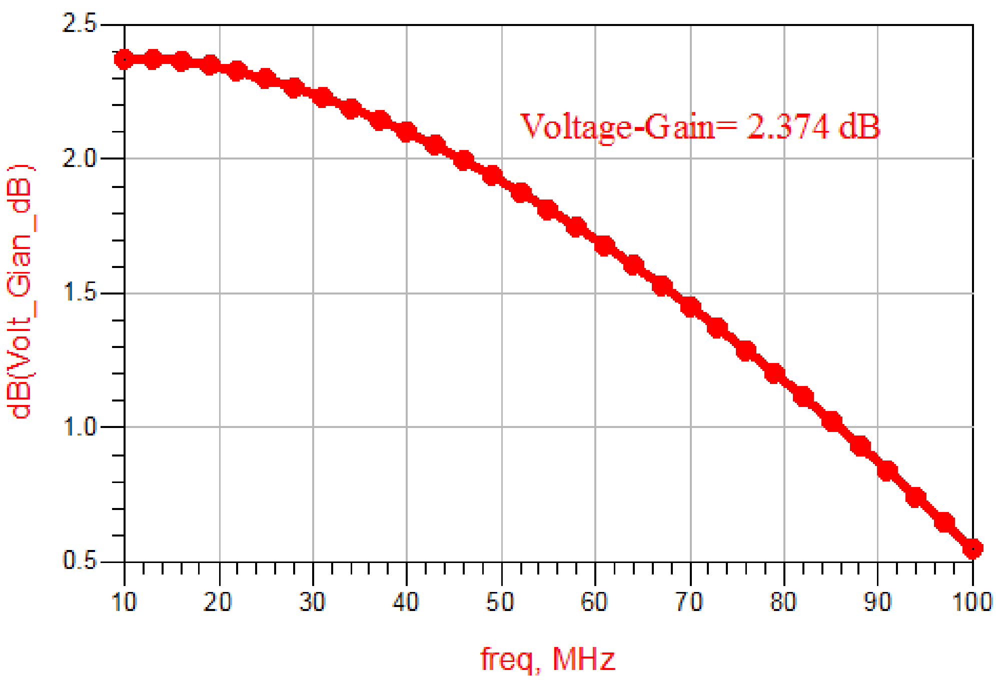

Figure 4: Gain diagram of the output voltage

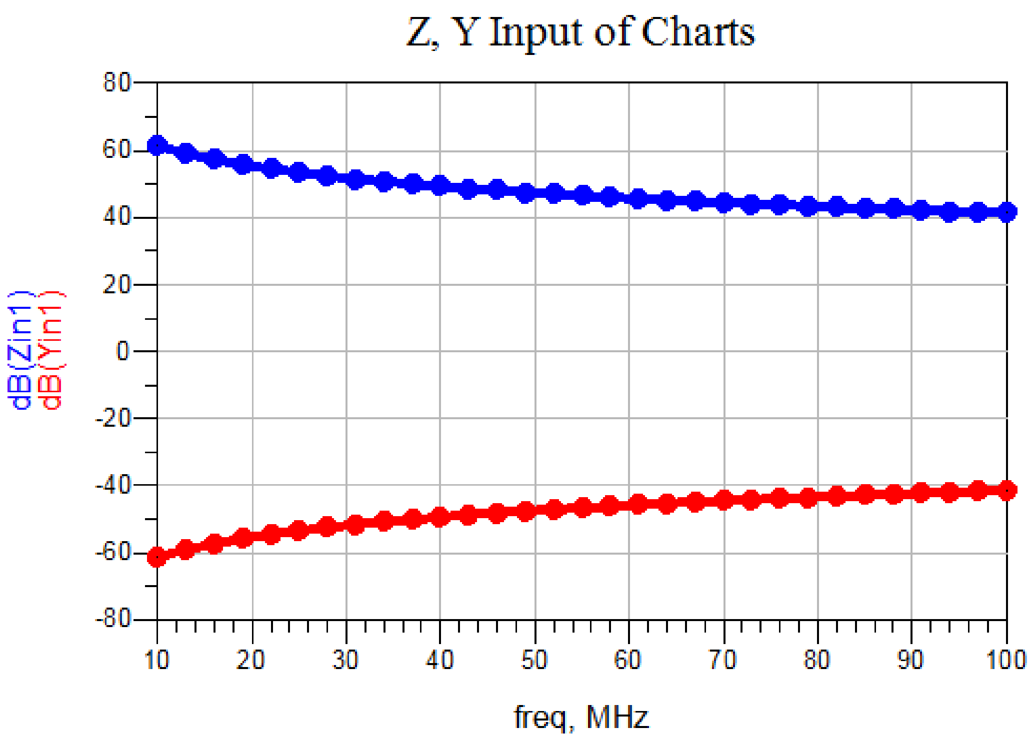

Figure 5: Input Chart for Z, Y Quantifiers

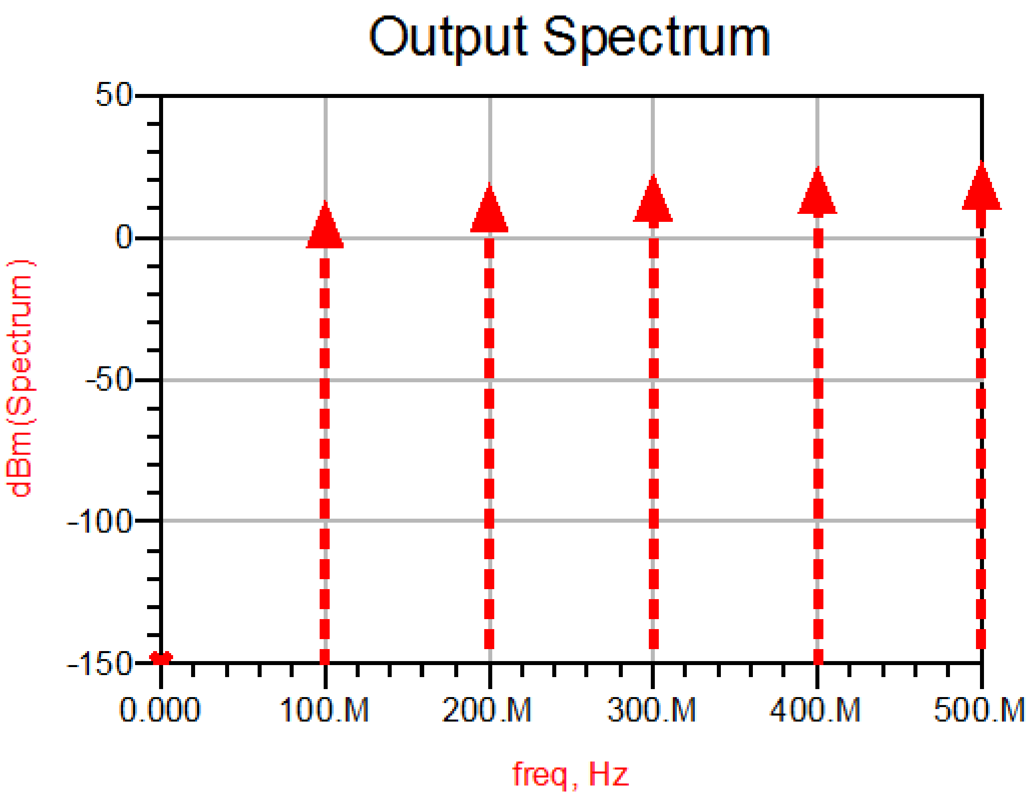

Figure 6: Characteristic spectrum of active filter output

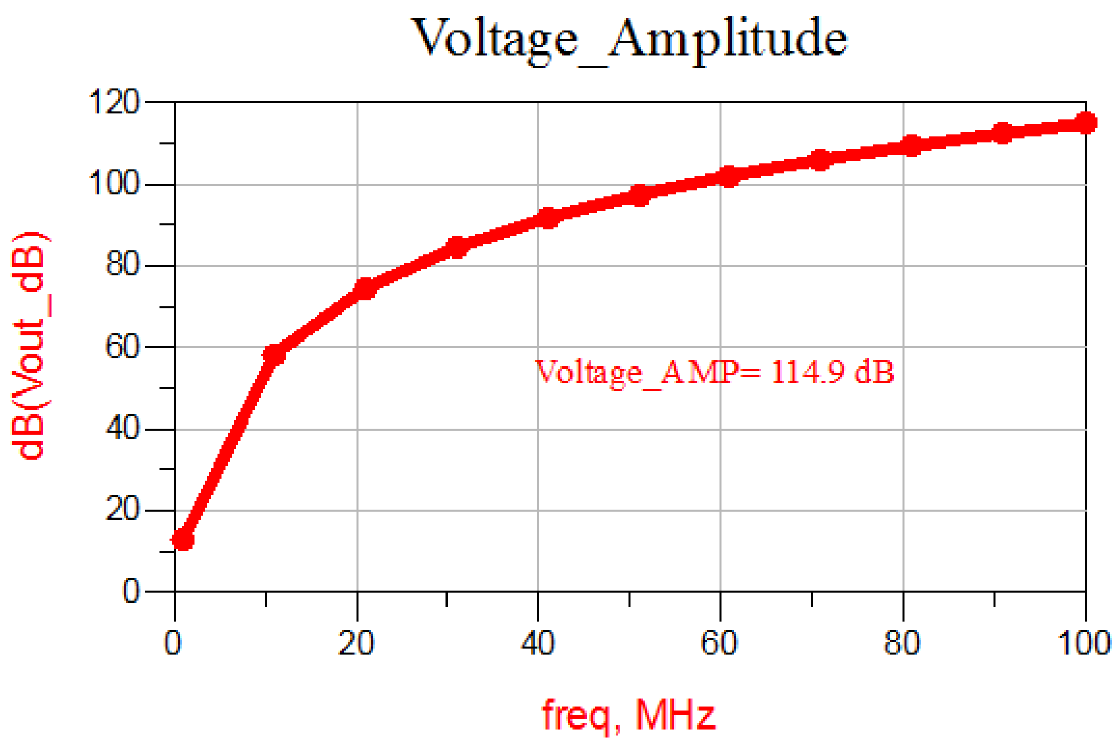

Figure 7: Output voltage diagram according to the applied amplitude of the circuit

Conclusion

In this proposed circuit, we have designed and analyzed high-voltage DC filters. This circuit has a rectifier structure and a voltage filter in the range of 50-220V. This circuit is based on the second-order differential Cascode structure with the mirror circuit technique in the positive and negative polarities of the DC power line. By applying these techniques, the structure of the transistor at the beginning and the end of the circuit will improve the output voltage and reduce the voltage attenuation and distortion. In the structure of the high-voltage rectifier circuit, the photovoltaic system expects the output voltage to be without distortion, and at the same time, by applying a frequency in the bandwidth of 10-100 MHz, it improves the quality of the output voltage, and distortion and the time delay of the voltage relative to the frequency in The period of intense transition guidance is reduced. Because of this, the frequency is used in the circuit of the active filter rectifier circuit, which is designed in two sections of rectifier and voltage filtering, which has the voltage structure at the specified operating range. By applying a signal in these types of circuits, the efficiency of the circuit will be improved, and the coefficient of the delayed circuit and the voltage drop of the circuit will be greatly reduced. Circuit operation in photovoltaic systems is accomplished with a favorable transient conduction efficiency coefficient, which requires the creation of a transistor circuit design in the differential function of the Cascode technique and the application of a low bandwidth signal in the transmission of voltage and rectifier in the filter. The proposed circuit is designed using ADS software using CMOS 0.18um transistor technology.

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