Study of FFT with Optically-Controlled Microwave Pulses in Non-uniform Plasma Layer

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Abstract: In this paper we study on the semiconductor characteristic by calculating the variation of reflection function in microstrip lines, which has open-ended termination containing an optically induced plasma region. The variation of impedances resulting from the presence of plasma has evaluated with time and frequency domain. The responses have been also evaluated theoretically for changing the phase of the variation in the reflection.

Key Words : Induced Plasma, Semiconductor Devices, Transient Response, Dielectric Microstrip Lines, Microwaves

1. INTRODUCTION

According to the analysis of the industry, over 60% of the production fault and more than 70% of the market back repair is due to the invalidation of device. And markets for large flat panel displays, such as liquid crystal displays and plasma display panels are growing, and large area and uniform density plasma equipment for the manufacture of large FPDs is desired. [1, 2].

And there has been considerable interest in the optical control of microwave and millimeter waves. This is due to the potential use of new microwave devices in high-speed signal processing, antenna beam scanning, phase shifters, modulators and optical switches [3]. The rapidly growing market of microwave and millimeter communication systems requires new approaches which may allow a more effective utilization of available frequency [4, 5].

In this study, we analyze the semiconductor plasma characteristics in the dielectric microstrip line with optically induced plasma region by the way of calculating the variation of the reflection function. The frequency used in the microstrip transmission line in this paper is from 1*GHz* to 256*GHz*.

2. EFFECTS OF PLASMA INDUCED LAYER

We treat a microstrip line on a semiconductor sub-strate, one end of which is open-ended and illuminated for optical injection of carriers with laser illumination. One end of the strip is connected to an input/output port and the other end is open-terminated as shown also in Fig. 1.

The dielectric constant in the plasma-induced layer semiconductor material can be analyzed by the equation of motion of charge carriers in the semiconductor considering the classical electron-hole plasma theory as predicted by the Lorentz equation [5].

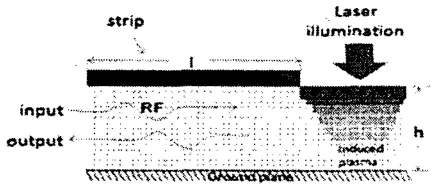

Fig. 1. The plasma induced microstrip line with controlled microwave.

3. PROPOSED TRANSIENT RESPONSE IN MICRO-STRIP LINE

Here in our proposed model, the capacitance and the conductance are also both taken into account system. Supposing that the equivalent terminal impedance at the open end is represented as Z_L, a transmission line model can be also expressed as shown in Fig. 2 with Z_L and the characteristic impedance Z_o

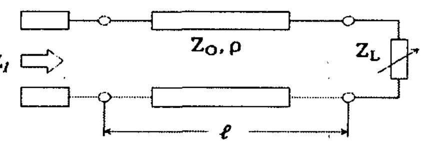

Fig. 2. Transmission line model with Microstrip lines.

By the transmission line equations, the input impedance Z_{IN} can be deduced from Z_L, Z_o and other parameters. Then the reflection wave function can be calculated by the circuit model through our suggested system, which has induced plasma with optically controlled pulses. Sections of transmission lines can be designed to give inductive or capacitance impedance and are used to match an arbitrary load to the internal impedance of a generator for maximum power transfer. The required length of sun lines as circuit elements becomes practical in the UFH range. In most cases transmission line segment can be considered lossless.

4. TRANSIENT RESPONSE IN PLASMA INDUCED LAYER

To estimate theoretically the characteristics response of our optically controlled microwave pulse systems in time domain, the transformation method has been used for evaluation. The Fourier transform in our equivalent model with microstrip lines has defined.

The two relations couple the time and frequency dependent responses for liner microwave circuits in our equivalent model. First, we have considered the pulse-modulated sinusoid signal for input estimation, which has the amplitude modulating carrier shifts angular frequency ω to $(\omega-\omega_0)$. The characteristics response for the pulse modulated signal, which is our equivalent model transient response, can be written by $O(\omega) = \tau_{in}(\omega)\, e(\omega)$ where $\tau_{in}(\omega)$ is dielectric variation in the plasma-induced layer and $e(w)$ is characteristics response in the frequency reflection variation.

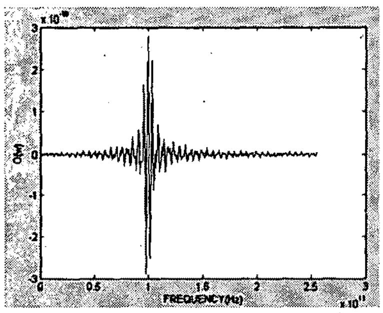

Fig. 3. The characteristics of transient response with shifted signal

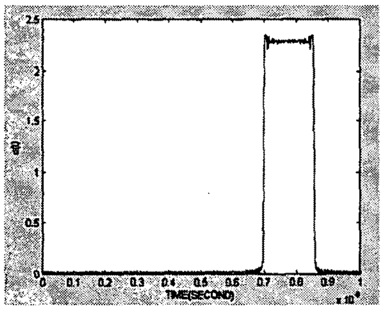

Fig. 4. Transient response in time domain by shifted signal.

Fig. 3 has shown in response of the reflection wave in our proposed equivalent model with dielectric plasma region, which has optically controlled microwave pulses. The signal has been disturbed in $16GHz$, which has compared with carrier shifts angular frequency. Fig. 4 depicts also the response of the Fourier transform of the reflection and displays the characteristics of transiently responded signal in time pulse as a result of shift. In Fig. 4 we can see that the input wave has been reflected and changing both the shifted energy towards with $16GHz$.

5. CONCLUSION

The reflection measurement of the open-ended microstrip lines which has a laser illuminated can be observed. The importance of the variation is that it can foresee the trend of changed transient response. By evaluating the variation of reflection coefficient, we can observe the change of the reflection amplitude. The variation of shifted level in average has few variation. The amplitude modulating carrier frequency shifts towards on modulated-response.

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