The matching of two-coupled lines microwave transforming four-poles without discrete elements using

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Abstract –**some variants of microwave transforming four-pole circuits on the base of two-coupled transmission lines, for the input matching of which the additional segments of single lines are used, are considered.**

Keywords **– coupled lines, even- and odd-mode analysis, differential phase shifter.**

I INTRODUCTION

The passive devices in the form of transforming four-poles on the base of segment of coupled transmission lines find wide application at the development of the microwave integrated circuits. Such four-poles are derived by connection the certain load to pair of coupled lines ends or by interconnection of two ends. The properties of device depend on that, which ends are connected or loaded, which is the load, what electrical parameters of coupled lines are used. As a result a four-pole can execute the function of differential or discrete phase shifter, phase equalizer, impedance transformer, frequency rejection circuit. Simultaneously with providing of the necessary working parameters at the designing of such devices it is necessary to solve the problem of input matching especially at the use of coupled lines with different phase velocities of even and odd modes as microstripe lines, for example. In [1], the methods for computation of coupled lines four-poles with one-sided loads, when the matching may be achieved by the use of one or few additional reactances placed between the coupled lines directly, are proposed. Such the matching method complicates construction especially, if there is a necessity to introduce an inductance between lines.

In the report it is proposed to solve the indicated problem without discrete elements by additional segments of single transmission line using.

II. VARIANTS OF FOUR-POLES MATCHING

In order to provide the input matching of the loaded coupled lines segment it is necessary to introduce the reactances into four-pole circuit. For their realization it is possible to use the segment of single line, which connects two ends of the coupled lines or a few segments, which are connected to coupled lines as the stubs. In Fig. 1 the different variants of matching and unequal phase velocities effect compensation of the transforming four-pole, which is formed by the coupled lines segment with one-sided load, are shown. The input and output lines have the characteristic impedance Z_c, the coupled lines – even and odd mode characteristic impedances Z_e, Z_o and electrical length θ_e, θ_o for these modes.

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In the circuit in Fig. 1,a two stabs with characteristic impedance Z and electrical length θ are used for the matching. They are placed symmetrically at some distance from the load formed by reactance jX_1 and jX_2. Depending on the value of these reactances the coupled lines can be with the open ends (X_1=X_2=∞), with the short ends (X_1=∞, X_2=0) or with the connected ends (X_1=0, X_2=∞).

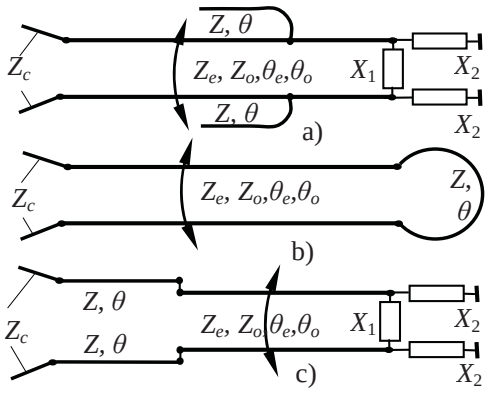

Fig. 1. Four-pole circuits with matching by stabs (a), by the segment of line between the coupled lines ends (b) and by the segments of line on the four-pole inputs (c).

In the circuit in Fig. 1,b the coupled lines ends are loaded by the segment of single line. The matching of such circuit depends on the parameters of this segment (characteristic impedance Z and electrical length θ).

The circuit in Fig. 1,c is matched by means of the segments of line with parameters Z and θ on the inputs of the four-pole, which is loaded by reactances jX_1 and jX_2 as well as in the case of circuit in Fig. 1,a.

The methods for aforecited circuit's computation for the desired operating regime are developed by the use of even- and odd-mode method. The electrical parameters Z and θ of matching elements may be calculated basing on the set parameters Z_e, Z_o, θ_e, θ_o of coupled lines.

III. CONCLUSIONS

The proposed variants of four-poles matching on the base of the coupled lines segment can be used for circuits with the bilateral and diagonal loads of such segment.

REFERENCES

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