13.4. CUADRIPOLI ECHIVALENTI SI SCHEME ECHIVALENTE

In regim permanent sinusoidal de frecventa data, doi cuadripoli sunt complet echivalenti, daca pot fi substituiti unul altuia in reteaua mai mare din care fac parte, fara ca sa modifice curentii si tensiunile din aceasta retea.

Determinarea unui cuadripol echivalent cu un cuadripol dat, este o operatie de transfigurare. Pentru ca doi cuadripoli sa fie complet echivalenti, e necesar si suficient sa aiba aceleasi ecuatii caracteristice – adica aceiasi parametrii $(\underline{A}, \underline{B}, \underline{C}, \underline{D})$ sau $(\underline{Z}_{11}, \underline{Z}_{12}, \underline{Z}_{22}, \underline{Z}_{21})$ sau $(\underline{Y}_{11}, \underline{Y}_{12}, \underline{Y}_{21}, \underline{Y}_{22})$, in cazul cvadripolilor diporti. Se numeste schema echivalenta a unui cvadripol reprezentarea in desen a structurii unui cvadripol fictiv, care ar avea aceiasi parametri, fara ca realizarea in concret a acestei structuri cu elemente dipolare de circuit (rezistoare, bobine, conductoare) sa fie neaparat posibila.In particular, nu e realizabila in concret o schema echivalenta, care contine impedante cu parte reala negativa. Daca o schema echivalenta este realizabila in concret, pe baza ei se poate construi un cvadripol echivalent, cuadripolului.

Deoarece un cuadripol diport, liniar, pasiv si reciproc are trei parametrii complecsi independenti, schemele echivalente, determinabile pentru orice cuadripol nedegenerat din aceasta clasa trebuie sa corespunda unor structuri cu cel putin trei impedante complexe. Cele mai simple scheme sunt cele in T si in π. In aplicatii se mai folosesc si alte scheme mai complicate, de exemplu, schema in punte, pentru care se poate demonstra ca exista o structura realizabila in concret, oricare ar fi cuadripolul liniar pasiv si reciproc dat.

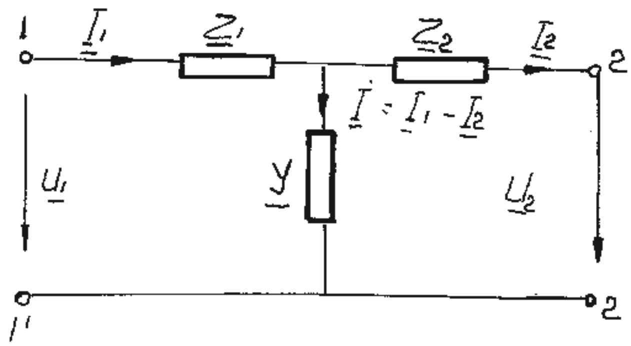

Fig. 13.10

13.4.1. Schema echivalenta in T (fig. 13.10)

Scriind ecuatiile lui Kirchhoff:

$$\underline{U}_1 = \underline{Z}_1 \underline{I}_1 + \underline{Z}(\underline{I}_1 - \underline{I}_2) = (\underline{Z}_1 + \underline{Z})\underline{I}_1 - \underline{Z}\underline{I}_2$$

$$\underline{U}_2 = -\underline{Z}_2 \underline{I}_2 + \underline{Z}(\underline{I}_1 - \underline{I}_2) = \underline{Z}\underline{I}_1 - (\underline{Z}_2 + \underline{Z})\underline{I}$$

in care apar direct parametrii impedanta.

$$\underline{Z}_{11} = \underline{Z}_1 + \underline{Z}; \quad \underline{Z}_{12} = -\underline{Z}; \ \underline{Z}_{21} = \underline{Z}; \quad \underline{Z}_{22} = -(\underline{Z}_2 + \underline{Z}) \qquad (13.38)$$

cu relatia (13.20) parametrii fundamentali sunt (cu $\underline{Y} = 1/\underline{Z}$)

$$\underline{A} = 1 + \underline{Z}_1\underline{Y}; \quad \underline{B} = \underline{Z}_1 + \underline{Z}_2 + \underline{Y}\underline{Z}_1\underline{Z}_2; \quad \underline{C} = \underline{Y}; \quad \underline{D} = 1 + \underline{Z}_2\underline{Y} \qquad (13.39)$$

Daca se considera un cuadripol dat, cu parametrii fundamentali $\underline{A}, \underline{B}, \underline{C}, \underline{D},$ impedantele si admitantele schemei echivalente, in T rezulta din relatia (13.39).

$$\underline{Y} = \underline{C}; \quad \underline{Z}_1 = \frac{\underline{A} - 1}{\underline{C}}; \quad \underline{Z}_2 = \frac{\underline{D} - 1}{\underline{C}} \qquad (13.40)$$

Pentru cuadripolii simetrici $\underline{Z}_1 = \underline{Z}_2$.

13.4.2. Schema echivalenta in p (fig. 13.11)

Scriind ecuatia II a lui Kirchhoff pe ochiul central rezulta:

$$O = -\underline{U}_1 + \underline{Z}\underline{I} + \underline{U}_2$$

$\underline{I} = \underline{Y}(\underline{U}_1 - \underline{U}_2)$ si

$$\underline{I}_1 = \underline{Y}_1\underline{U}_1 + \underline{I} = (\underline{Y}_1 + \underline{Y})\underline{U}_1 - \underline{Y}\underline{U}_2.$$

$$\underline{Y}_2 = \underline{I} - \underline{Y}_2\underline{U}_2 = \underline{Y}\underline{U}_1 - (\underline{Y}_2 + \underline{Y})\cdot\underline{U}_2.$$

Acestea sunt ecuatiile in care apar parametrii admitanta:

$$\underline{Y}_{11} = \underline{Y}_1 + \underline{Y}; \quad \underline{Y}_{12} = -\underline{Y}; \quad \underline{Y}_{21} = \underline{Y}; \quad \underline{Y}_{22} = -(\underline{Y}_2 + \underline{Y}) \quad (13.41)$$

Cu relatia (13.20), parametrii fundamentali sunt (cu $\underline{Z} = 1/\underline{Y}$)

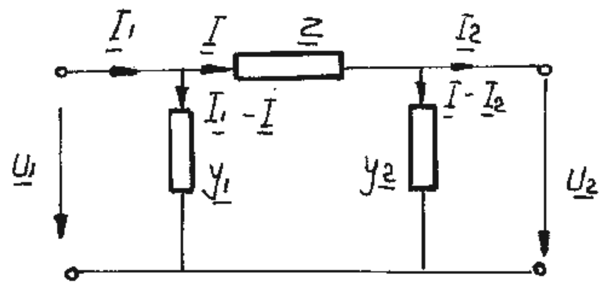

Fig. 13.11

$$\underline{A} = 1 + \underline{Y}_2\underline{Z}; \quad \underline{B} = \underline{Z},; \quad \underline{C} = \underline{Y}_1 + \underline{Y}_2 + \underline{Z}\underline{Y}_1\underline{Y}_2; \quad \underline{D} = 1 + \underline{Y}_1\underline{Z} \quad (13.42)$$

Daca se considera un cuadripol dat, cu parametrii fundamentali $\underline{A}, \underline{B}, \underline{C}, \underline{D}$ impedantele si admitantele echivalente in π rezulta din (13.42).

$$\underline{Z} = \underline{B}; \quad \underline{Y}_1 = \frac{\underline{D} - 1}{\underline{B}}; \quad \underline{Y}_2 = \frac{\underline{A} - 1}{\underline{B}} \quad (13.43)$$

pentru cuadripoli simetrici $\underline{Y}_1 = \underline{Y}_2$.