



Tema I Bazele Electrotehnicii

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1 Exercițiul 1

1.1 Circuit electric liniar rezistiv

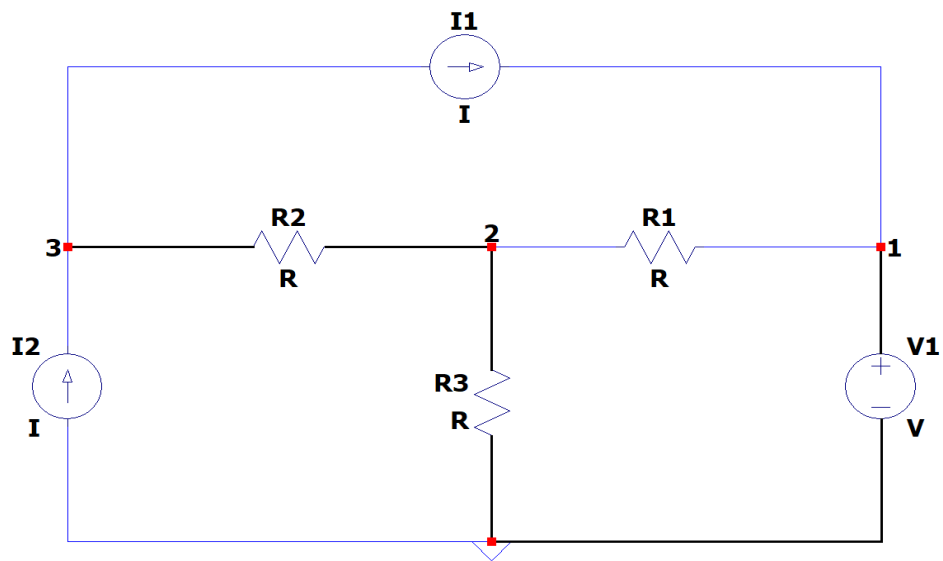


Figura 1: Circuit electric liniar rezistiv

Am generat un circuit liniar cu $N = 4$ noduri , $L = 6$ laturi , $N - 1 = 3$ ramuri si 3 coarde. Circuitul contine 2 surse ideale de curent (SIC) , 2 surse ideale de tensiune (SIT) si 3 rezistori (R). Am ales un graf in interiorul circuitului , care sa nu se inchida , marcat in desen de laturile de culoare neagra .

1.2 Graful Tensiunilor

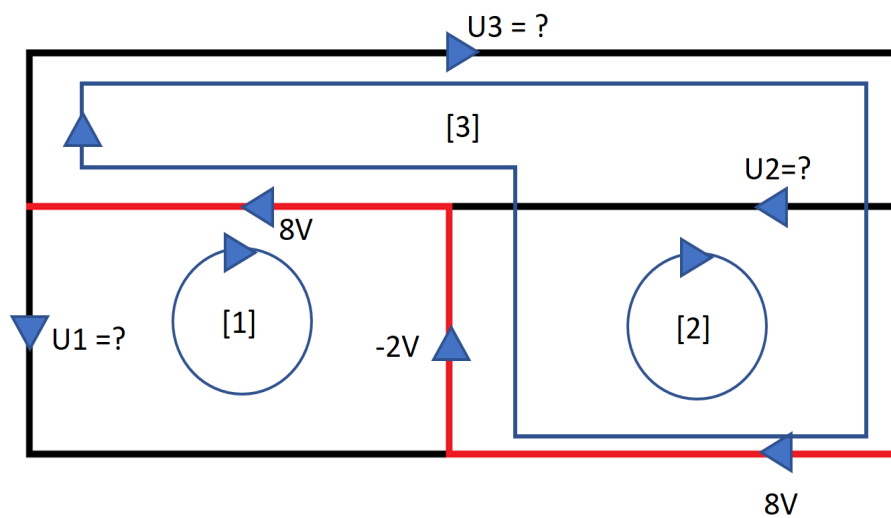


Figura 2: Graful Tensiunilor

Pentru bucla [1] vom avea

$$U1 + 8 - 2 = 0$$

$$U1 + 6 = 0$$

$$\mathbf{U1 = -6}$$

Pentru bucla [2] vom avea

$$U2 - 8 + 2 = 0$$

$$U2 - 6 = 0$$

$$\mathbf{U2 = 6}$$

Pentru bucla [3] vom avea

$$-U3 - 8 + 2 - 8 = 0$$

$$-U3 - 16 + 2 = 0$$

$$-U3 - 14 = 0$$

$$\mathbf{U3 = -14}$$

1.3 Graful Intensitatilor

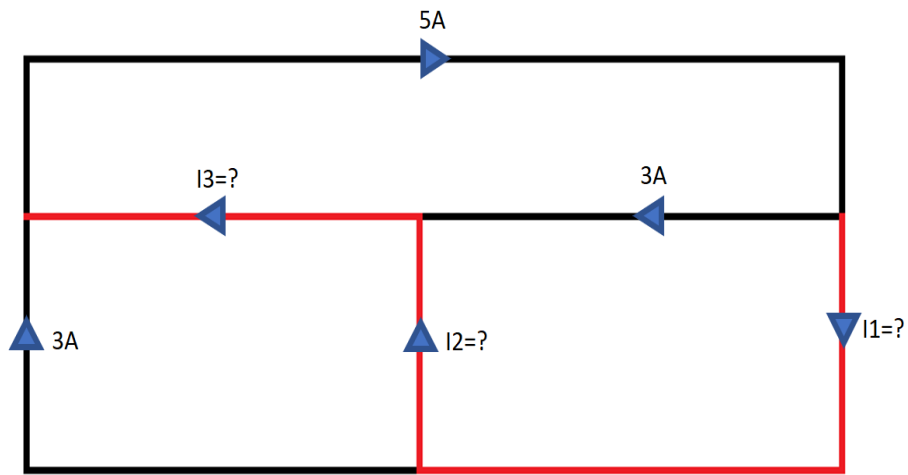


Figura 3: Graful Intensitatilor

Calculez parametrii elementelor de pe laturi:

$$I1 + 3 = 5 \Rightarrow I1 = 5 - 3 \Rightarrow I1 = 2A$$

$$I2 + 3 = I1 \Rightarrow I2 = I1 - 3 \Rightarrow I2 = 2 - 3 \Rightarrow I2 = -1A$$

$$I3 + 3 = 5 \Rightarrow I3 = 5 - 3 \Rightarrow I3 = 2A$$

Calculez parametrii elementelor de pe laturi:

$$R1 = \frac{U2}{3} = \frac{6}{3} = 2\Omega$$

$$R2 = \frac{8}{I3} = \frac{8}{2} = 4\Omega$$

$$R3 = \frac{-2}{I2} = \frac{-2}{-1} = 2\Omega$$

2 Metode sistematice eficiente

Pentru Kirchhoff clasic voi avea $2L = 12$ ecuatii .

Pentru Kirchhoff in curenti voi avea $L - N + 1 = 3$ ecuatii .

Pentru Kirchhoff in tensiuni voi avea $N - 1 = 3$ ecuatii .

Pentru Curenti de coarde voi avea $L - N + 1 - NR_{sic} = 1$ ecuatie .

Pentru Tensiuni in ramuri voi avea $N - 1 - NR_{sit} = 2$ ecuatie .

Cea mai eficienta metoda este cea a curentilor prin coarde .

2.1 Graful marcat cu Sectiuni

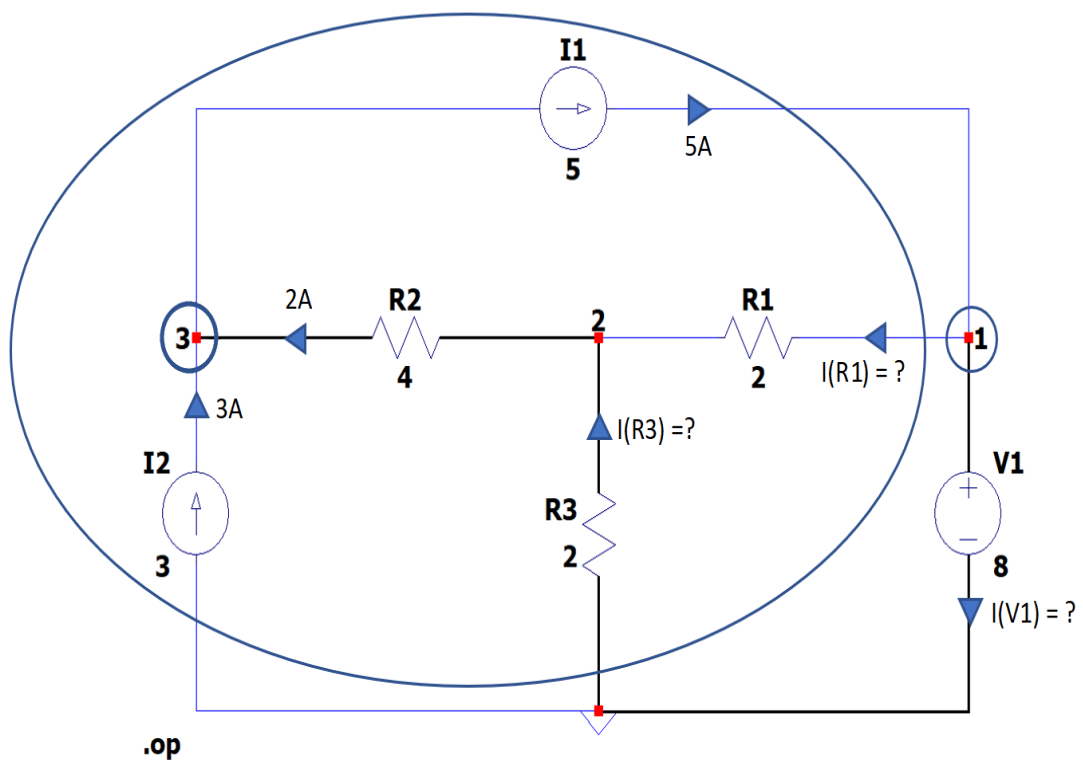


Figura 4: Graf cu Sectiuni

$$I(R1) + I(V1) = 5A \Rightarrow I(V1) = 5 - I(R1) \Rightarrow I(V1) = 5 - 2 + I(R3) \Rightarrow I(V1) = 3 + I(R3)$$

$$I(R1) + I(R3) = 2A \Rightarrow I(R1) = 2 - I(R3)$$

2.2 Graful marcat cu Bucla

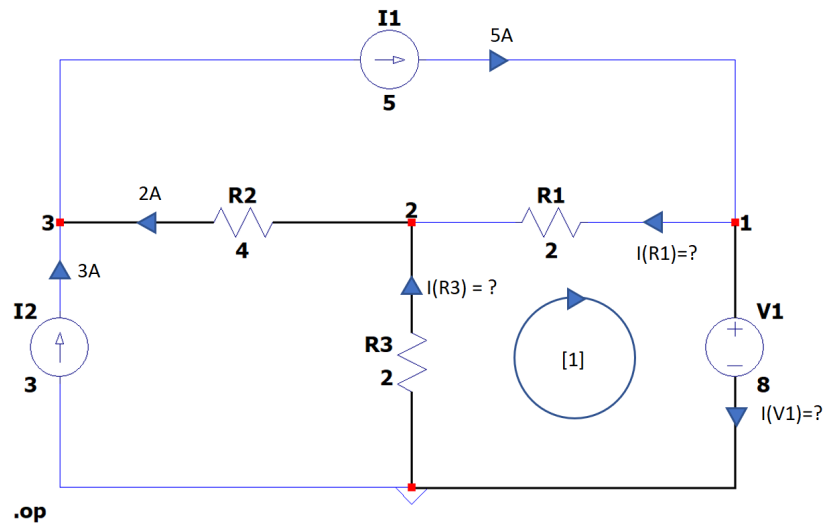


Figura 5: Graf cu Bucla

$$I(R3) \cdot R3 - I(R1) \cdot R1 = V1 \Rightarrow I(R3) \cdot R3 - [2 - I(R3)] \cdot R1 = V1 \Rightarrow 2I(R3) - 4 + 2I(R3) = -8 \Rightarrow I(R3) = -1A$$

Vom avea ca rezultat :

$$I(R1) = 2 + 1$$

$$I(R1) = 3A$$

$$I(V1) = 3 - 1$$

$$I(V1) = 2A$$

2.3 Verificarea Bilantului de Puteri

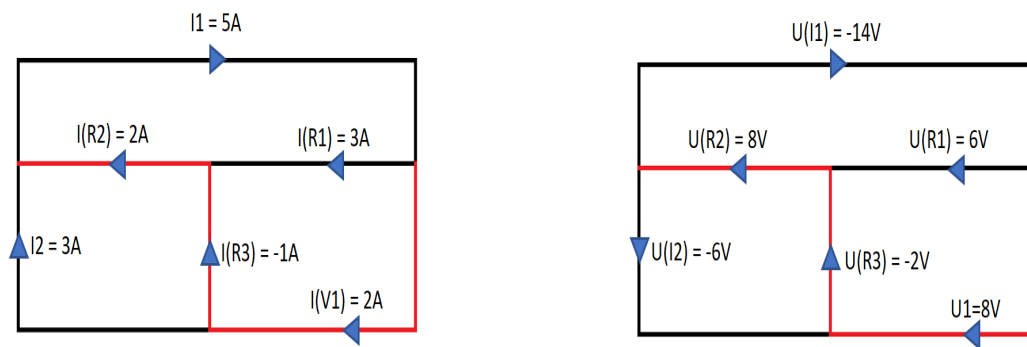


Figura 6: Graful Intensitatii si Graful Tensiunii

$$Pc = I(R1)^2 \times R1 + I(R2)^2 \times R2 + I(R3)^2 \times R3 = 4 \times 4 + 9 \times 2 + 2 \times 1 = 16 + 18 + 2 = 36W$$

$$Pg = -I1 \times U(I1) - I(V1) \times U(V1) - I2 \times U(I2) = 70 - 18 - 16 = 36W$$

3 Generatorul echivalent de tensiune/curent

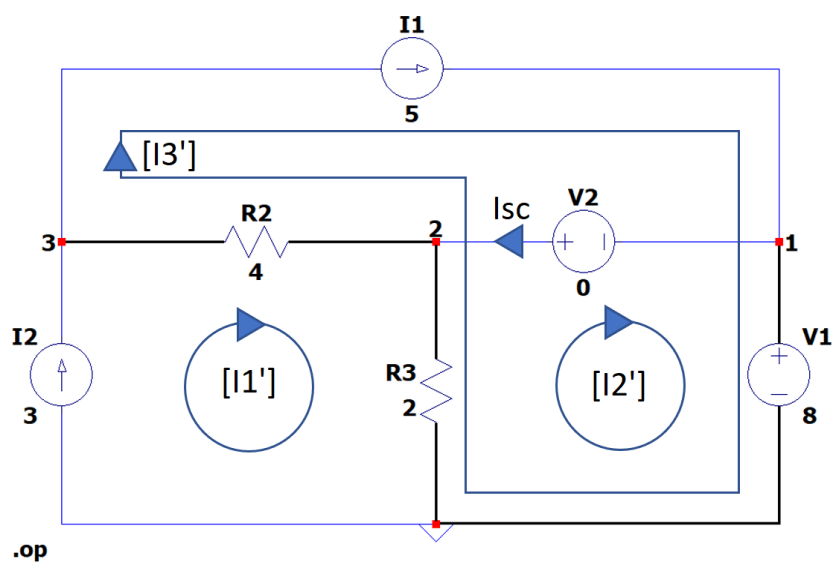


Figura 7: Circuitul Scurtcircuitat

$$R11 \times I1' + R12 \times I2' + R13 \times I3' = E1'$$

$$R21 \times I1' + R22 \times I2' + R23 \times I3' = E2'$$

$$R_{31} \times I_1' + R_{32} \times I_2' + R_{33} \times I_3' = E_3'$$

$$I_1' = 3A$$

$$I_3' = 5A$$

$$R_{12} = R_{21} = 2$$

$$R_{13} = R_{31} = -6$$

$$R_{23} = R_{32} = 2$$

$$R_{22} = 2$$

$$10 + 2I_2' + 6 = 8 \Rightarrow I_2' = -4A$$

Intensitatea de scurtcircuit este :

$$I_{sc} = -I_2' - I_1' + I_3' \Rightarrow I_{sc} = 4 - 3 + 5 \Rightarrow I_{sc} = 6A$$

Rezistenta echivalenta este o rezistenta paralela :

$$R_{120} = \frac{R_2 + R_3}{R_2 \times R_3} = \frac{4 + 2}{4 \times 2} = \frac{6}{8} = \frac{3}{4} = 0.75\Omega$$

$$U_{120} = \frac{I_{sc}}{\frac{1}{R_{120}} + \frac{1}{R_{12}}}$$

$$U_{120} = \frac{6}{\frac{1}{\frac{3}{4}} + \frac{1}{2}} = \frac{6}{\frac{1}{0.75} + \frac{1}{2}} \approx 3.27V$$

3.1 Graficul Dependentelor

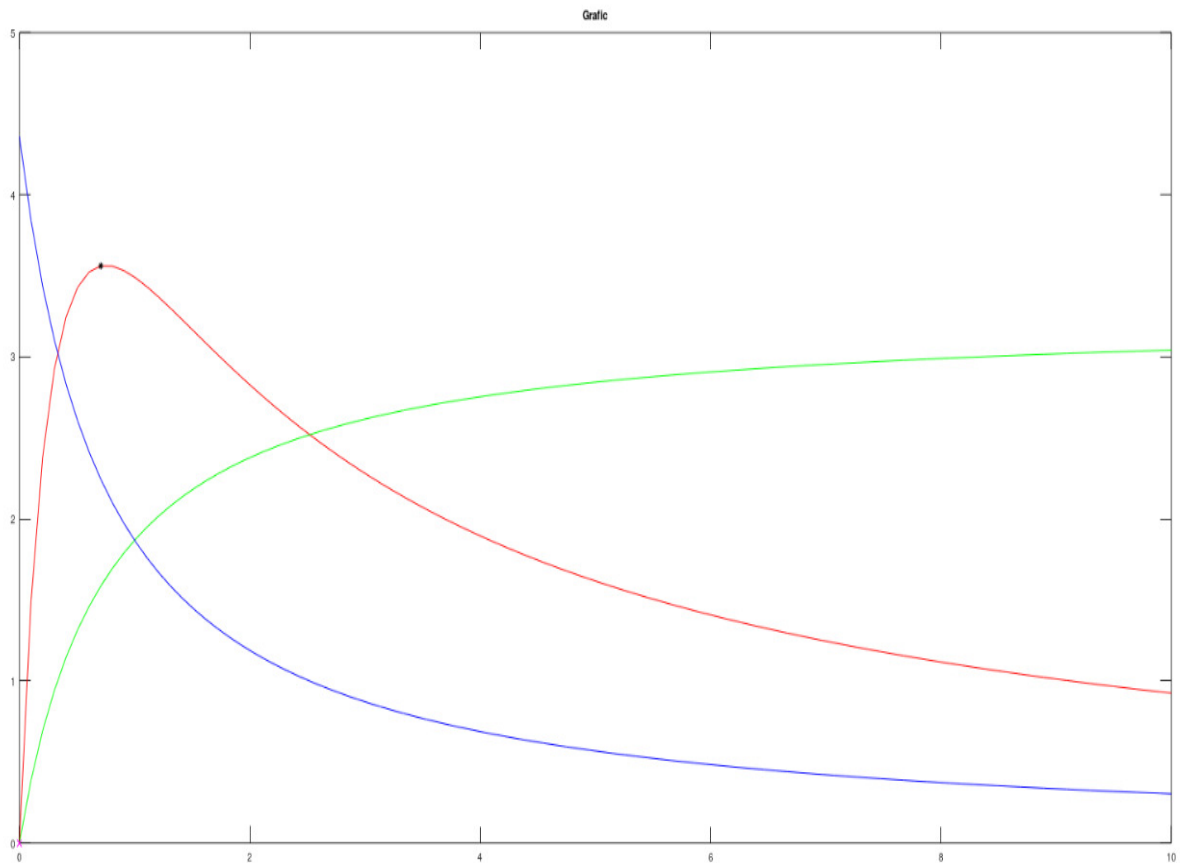


Figura 8: Graficul Intensitatii , Puterii si al Tensiunii

Curba marcata cu rosu reprezinta Graficul Puterii

Curba marcata cu verde reprezinta Graficul Tensiunii

Curba marcata cu albastru reprezinta Graficul Intensitatii

Punctul in care se realizeaza transferul maxim de putere este dat de coordonatele $x=0.71$ si $y=21.3$

In punctul initial de functionare al rezistorului , tensiunea are valoarea $y= 4.4$, iar puterea si intensitatea $y = 0$

3.2 Graficul Intensitatii

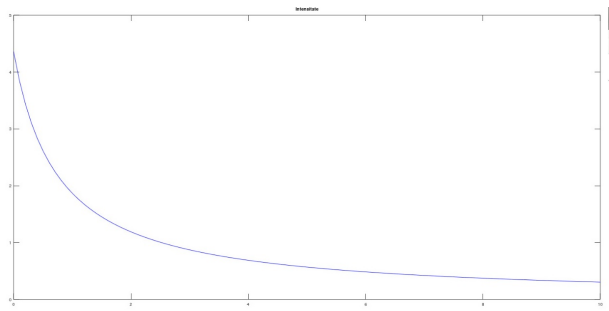


Figura 9: Graficul Intensitatii

3.3 Graficul Tensiunii

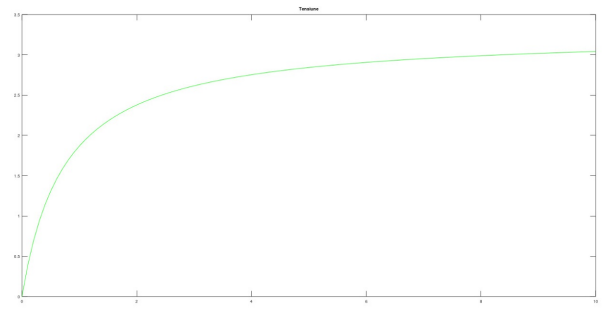


Figura 10: Graficul Tensiunii

3.4 Graficul Puterii

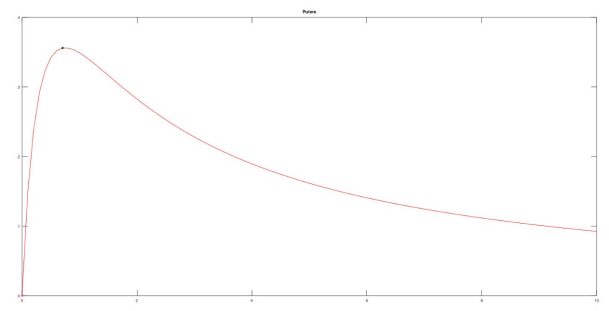


Figura 11: Graficul Puterii

```

1 function Putere(R120,U120)
2   R = linspace(0,10,100);
3
4   for i = 1:100
5
6       if( i == 1 )
7
8           I = U120 / (R(i) + R120);
9           U = I(i) * R(i);
10          P = U(i) * I(i);
11
12       else
13
14           I = [ I , U120 / (R(i) + R120) ];
15           U = [ U , I(i) * R(i) ];
16           P = [ P , U(i) * I(i) ];
17
18       endif
19
20   endfor
21
22   Pmax = max(P);
23   idx = find(P == Pmax);
24
25   y = P(idx);
26   x = R(idx);
27
28   figure(1);
29   plot(R,P,"r");
30   hold on
31   plot(x,y,'k*');
32   plot(0,P(1),'mx');
33   title ("Putere");
34
35   figure(2);
36   plot(R,U,"g");
37   title ("Tensiune");
38
39   figure(3);
40   plot(R,I,"b");
41   title ("Intensitate");
42
43   figure(4);
44   plot(R,P,"r",R,U,"g",R,I,"b");
45   hold on
46   plot(x,y,'k*');
47   plot(0,P(1),'mx');
48   title ("Grafic");
49
50 endfunction

```

3.5 Caracteristica rezistorului liniar si caracteristica generatorului echivalent

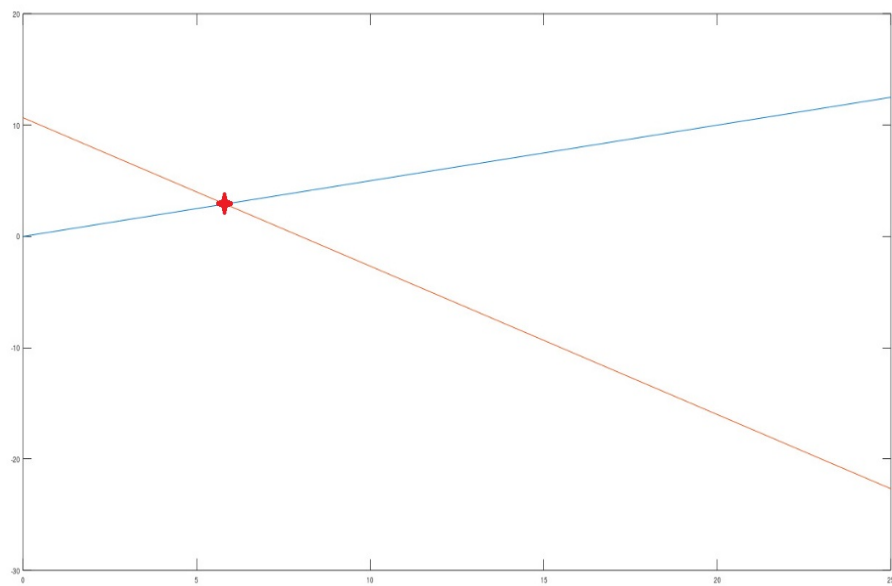


Figura 12: Graficul Caracteristicilor

```
1
2 function caract()
3
4     U = linspace(0,25,100);
5     R1 = 2;
6     R120 = 0.75;
7     Ee = 8;
8
9     for i = 1:100
10
11         if(i == 1)
12
13             I = U(i)/R1;
14             Id = (Ee - U(i))/R120;
15
16         else
17
18             I = [I , U(i)/R1];
19             Id = [Id , (Ee - U(i))/R120];
20
21         endif
22
23     endfor
24
25     plot(U,I,U,Id);
26
27 endfunction
```

3.6 Dioda Semiconductoare

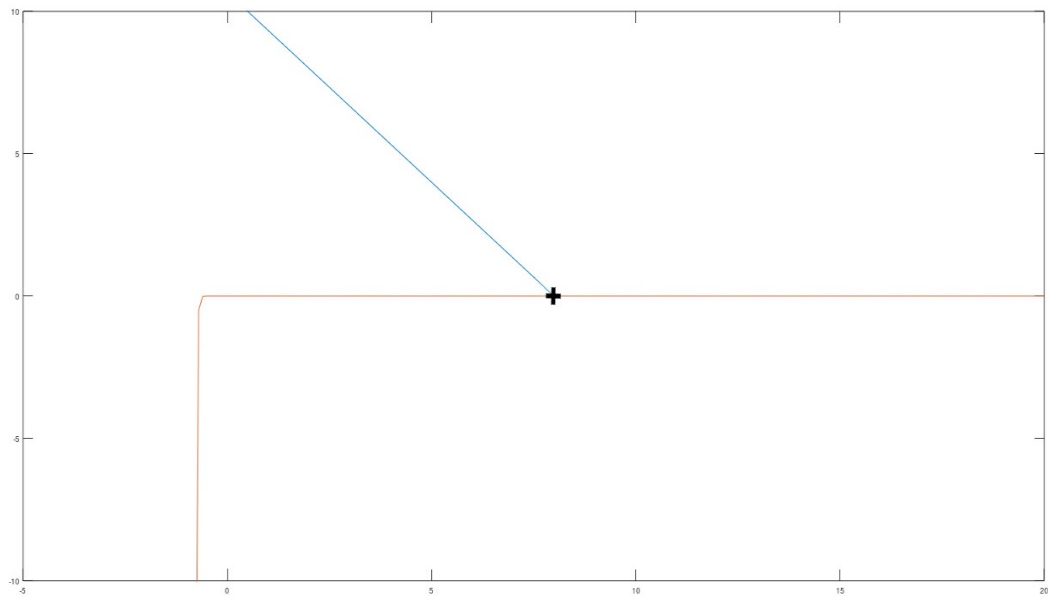


Figura 13: Graficul Metodei Inverse

```
1
2 function MetodaDiodaIndirecta(Ee,R120)
3
4     R = linspace(0,100,100);
5
6     for i = 1 : 100
7
8         I1(i) = Ee / ( R120 + R(i) );
9         U1(i) = I1(i) * R(i);
10
11     endfor
12
13     U = -20 : 0.1 : 20;
14     I = -10^(-12) * ( exp( U / 0.026 ) - 1 );
15
16     plot( U1 , I1 );
17     hold on
18     plot( -U , I );
19
20     xlim([ -5;20]);
21     ylim([ -10;10]);
22
23 endfunction
```

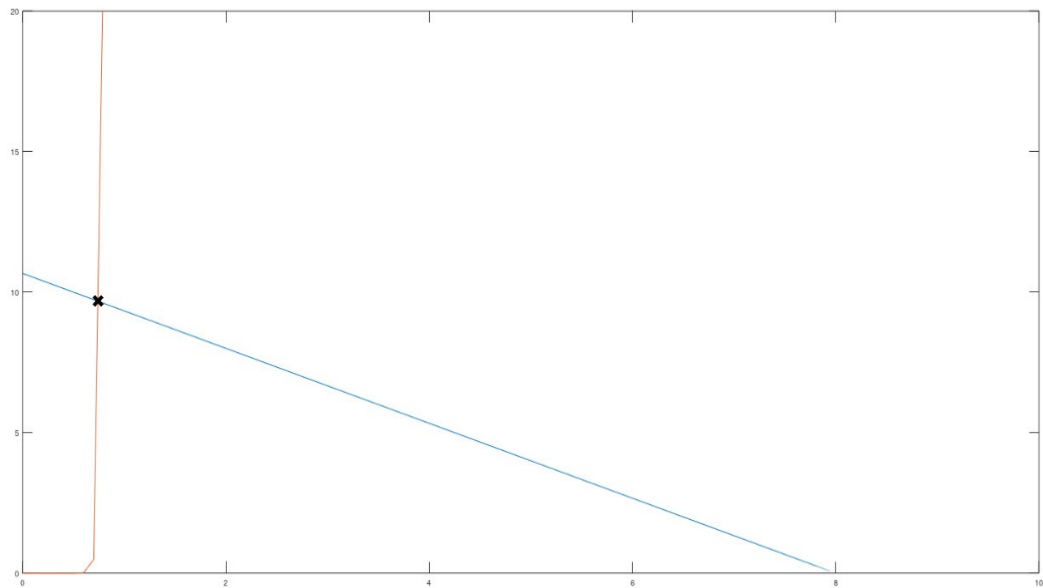


Figura 14: Graficul Metodei Directe

```

1
2 function MetodaDiodaDirecta(Ee,Rab)
3
4 R = linspace(0,100,100);
5
6 for i = 1 : 100
7
8     I1(i) = Ee / ( R(i) + Rab );
9     U1(i) = I1(i) * R(i);
10
11 endfor
12
13 U = -20 : 0.1 : 20;
14 I = 10^(-12) * ( exp( U / 0.026 ) - 1 );
15
16 plot( U1 , I1 );
17 hold on
18 plot( U , I );
19
20 ylim([-0 20]);
21 xlim([-0 10]);
22
23 endfunction

```

4 Exercițiul 4

4.1 Surse Comandate

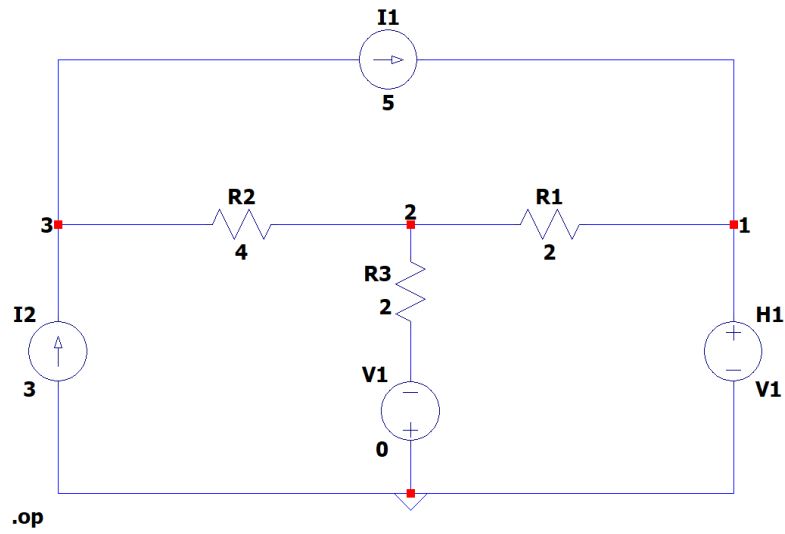


Figura 15: Circuitul dupa transformarea unui SIT in SUCI

$$R_{transfer} = \frac{V1}{I(R3)} = \frac{8}{-1} = -8\Omega$$

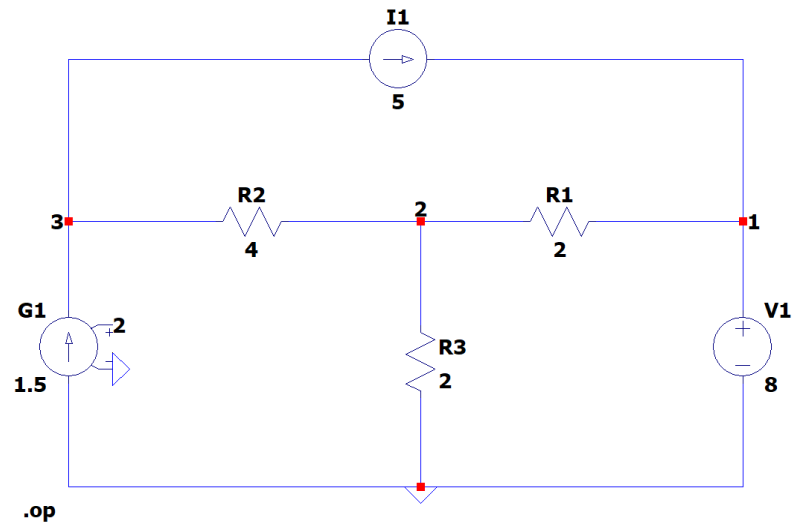


Figura 16: Circuitul dupa transformarea unui SIC in SICU

$$Conductantdetransfer = \frac{I2}{R3} = \frac{3}{2} = 1.5 \frac{A}{V}$$

4.2 Simulare LTspice

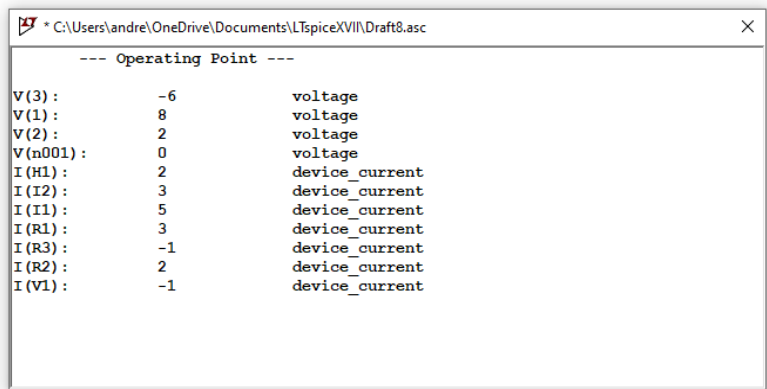


Figura 17: Valori SICU

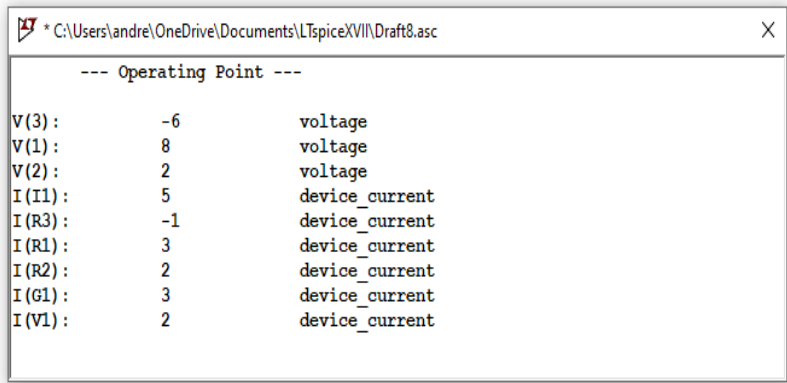
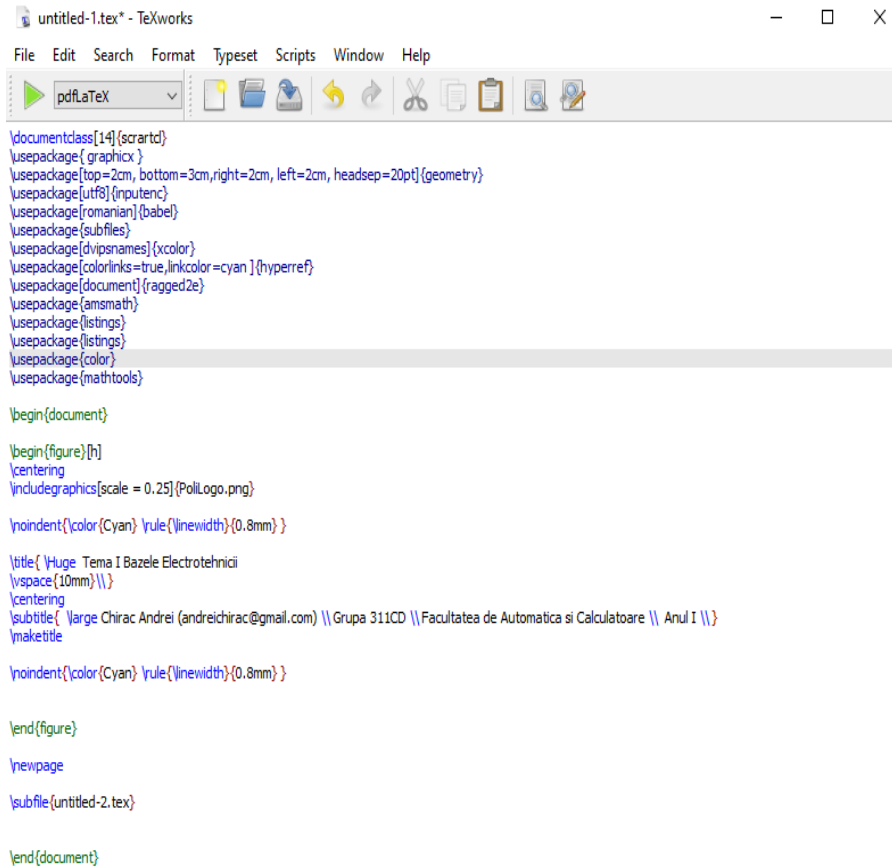


Figura 18: Valori SICU

5 Exercițiul 5

5.1 Pagina de inceput



The screenshot shows a TeXworks editor window titled 'untitled-1.tex* - TeXworks'. The interface includes a menu bar (File, Edit, Search, Format, Typeset, Scripts, Window, Help) and a toolbar with icons for opening, saving, undo, redo, and other editing functions. The main text area contains the following LaTeX code:

```
\documentclass[14]{scrartcl}
\usepackage{graphicx}
\usepackage[top=2cm, bottom=3cm, right=2cm, left=2cm, headsep=20pt]{geometry}
\usepackage[utf8]{inputenc}
\usepackage[romanian]{babel}
\usepackage{subfiles}
\usepackage{dvipsnames}{xcolor}
\usepackage{colorlinks=true, linkcolor=cyan}{hyperref}
\usepackage{document}{ragged2e}
\usepackage{amsmath}
\usepackage{listings}
\usepackage{listings}
\usepackage{color}
\usepackage{mathtools}

\begin{document}

\begin{figure}[h]
\centering
\includegraphics[scale = 0.25]{PolLogo.png}

\noindent{\color{Cyan} \rule{\linewidth}{0.8mm} }

\title{ \huge Tema I Bazele Electrotehnicii
\vspace{10mm} \\\}
\centering
\subtile{ \large Chirac Andrei (andreichirac@gmail.com) \\\ Grupa 311CD \\\ Facultatea de Automatica si Calculatoare \\\ Anul I \\\}
\maketitle

\noindent{\color{Cyan} \rule{\linewidth}{0.8mm} }

\end{figure}

\newpage

\subfile{untitled-2.tex}

\end{document}
```

Figura 19: Codul Latex pentru pagina de inceput

5.2 Continutul lucrării



```
untitled-2.tex - TeXworks
File Edit Search Format Typeset Scripts Window Help
pdfLaTeX
R1 = \frac{U2}{3} = \frac{6}{3} = 2 \Omega
\end{equation*}

\begin{equation*}
R2 = \frac{8}{13} = \frac{8}{2} = 4 \Omega
\end{equation*}

\begin{equation*}
R3 = \frac{-2}{12} = \frac{-2}{-1} = 2 \Omega
\end{equation*}

\end{flushleft}

\newpage

\section{Metode sistematice eficiente }

\begin{flushleft}
Pentru \textbf{Kirchhoff clasic} voi avea \textbf{2L = 12 ecuatii}. \textbf{Pentru Kirchhoff in curenti} voi avea \textbf{L - N + 1 = 3}
ecuatii. \textbf{Pentru Kirchhoff in tensiuni} voi avea \textbf{N - 1 = 3 ecuatii}. \textbf{Pentru Curenti de coarde} voi avea
\textbf{L - N + 1 - NRsc = 1 ecuatie}. \textbf{Pentru Tensiuni in ramuri} voi avea \textbf{N - 1 - NRsit = 2 ecuatie}.
\newline
\hfill
\end{flushleft}

Cea mai eficienta metoda este cea a \textbf{curentilor prin coarde}.
\end{flushleft}

\subsection{Graful marcat cu Sectiuni }

\begin{figure}[ht]
\centering
\includegraphics[width=15cm,height=11cm]{GrafcuCerc.png}
\caption{ Graf cu Sectiuni }
\label{fig:Graf cu Sectiuni }
\end{figure}

\begin{flushleft}

\begin{equation*}
I(R1) + I(V1) = 5A \Rightarrow I(V1) = 5 - I(R1) \Rightarrow I(V1) = 5 - 2 + I(R3) \Rightarrow I(V1) = 3 + I(R3)
\end{equation*}

\begin{equation*}
I(R1) + I(R3) = 2A \Rightarrow I(R1) = 2 - I(R3)
\end{equation*}

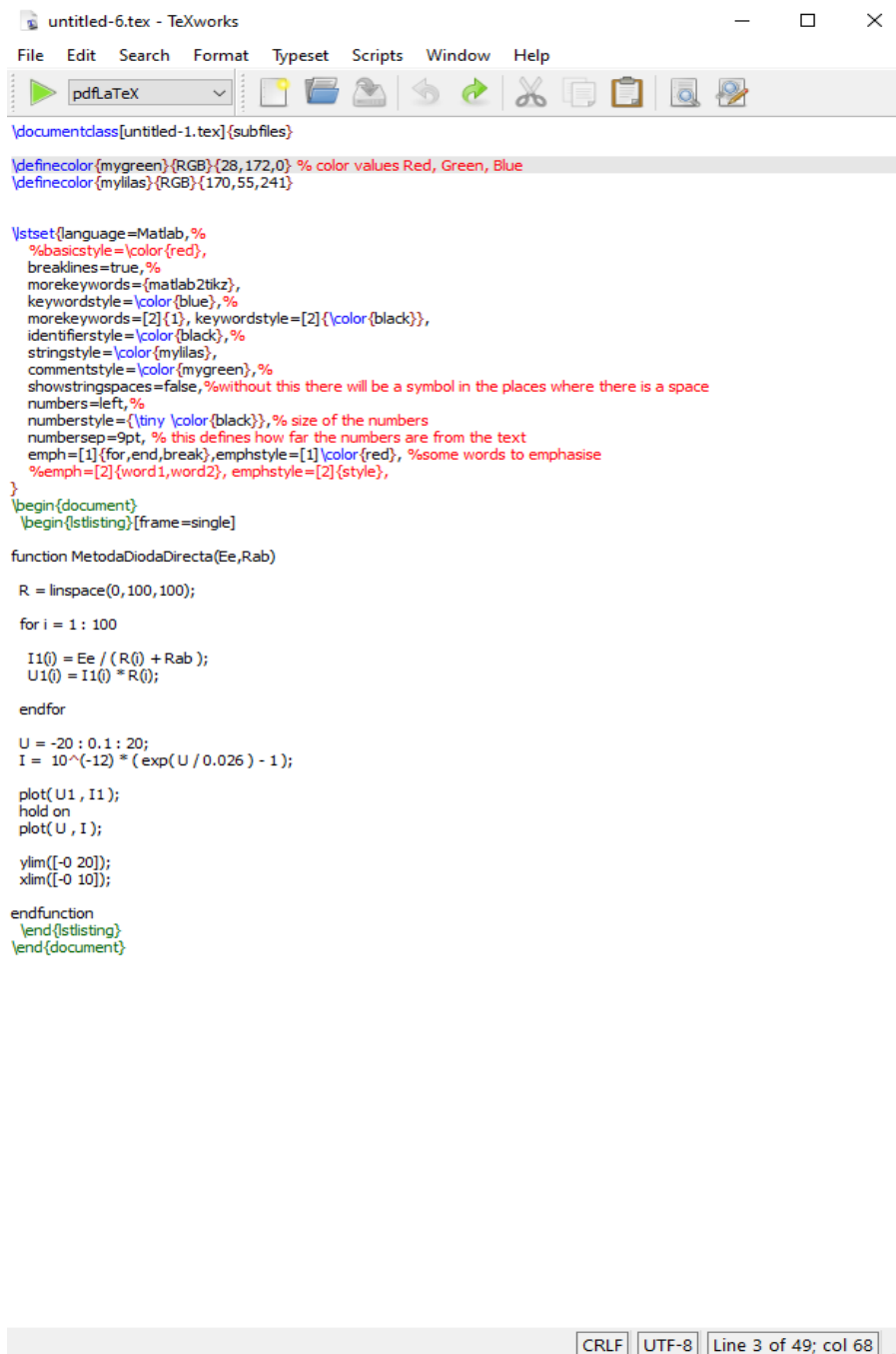
\end{flushleft}

\newpage

\subsection{Graful marcat cu Bucla }
```

Figura 20: O parte din codul Latex pentru continutul lucrării

5.3 Implementate in octave



The screenshot shows the TeXworks editor interface. The title bar reads "untitled-6.tex - TeXworks". The menu bar includes "File", "Edit", "Search", "Format", "Typeset", "Scripts", "Window", and "Help". The toolbar contains icons for opening files, saving, undo, redo, and other editing functions. The main text area contains the following LaTeX code:

```
\documentclass[untitled-1.tex]{subfiles}

\definecolor{mygreen}{RGB}{28,172,0} % color values Red, Green, Blue
\definecolor{myllilas}{RGB}{170,55,241}

\lstset{language=Matlab,%
  %basicstyle=\color{red},
  breaklines=true,%
  morekeywords={matlab2tikz},
  keywordstyle=\color{blue},%
  morekeywords={1}, keywordstyle={2}{\color{black}},
  identifierstyle=\color{black},%
  stringstyle=\color{myllilas},
  commentstyle=\color{mygreen},%
  showstringspaces=false,%without this there will be a symbol in the places where there is a space
  numbers=left,%
  numberstyle={\tiny \color{black}},% size of the numbers
  numbersep=9pt,% this defines how far the numbers are from the text
  emph=[1]{for,end,break},emphstyle=[1]\color{red}, %some words to emphasise
  %emph=[2]{word1,word2}, emphstyle=[2]{style},
}
\begin{document}
\begin{lstlisting}[frame=single]

function MetodaDiodaDirecta(Ee,Rab)

R = linspace(0,100,100);

for i = 1 : 100

    I1(i) = Ee / ( R(i) + Rab );
    U1(i) = I1(i) * R(i);

endfor

U = -20 : 0.1 : 20;
I = 10^(-12) * ( exp( U / 0.026 ) - 1 );

plot( U1 , I1 );
hold on
plot( U , I );

ylim([-0 20]);
xlim([-0 10]);

endfunction
\end{lstlisting}
\end{document}
```

At the bottom of the editor, there is a status bar showing "CRLF", "UTF-8", and "Line 3 of 49; col 68".

Figura 21: Codul Latex pentru una dintre functiile implementate in octave

6 Bibliografie

Aurel Sorin Lup
Planse de seminar - Metode de analiza a circuitelor electrice

Mihai Popescu
Tutorial video Laborator 2

Ajutor in limabjul LaTeX
Disponibil la <https://www.overleaf.com/learn>

G. Ciuprina, A. Gheorghe, M. Popescu, D. Niculae, A.S. Lup, R. Barbulescu, D. Ioan
Modelarea si simularea circuitelor electrice. Indrumar de laborator pe care il putem gasi la :
https://acs.curs.pub.ro/2019/pluginfile.php/60444/mod_resource/content/5/indrumar_draft_19februarie2016.pdf