Project report

CIRCUIT ANALYSIS

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PROBLEM:

We have an electric circuit consisting of group of resistors and cells connected (where each resistance varies as a function of time). in it we want to find the effective resistance, current through all resistors as a function of time , a certain maximised path(flow of current) and analyze their variation with time graphically.

The path is maximised by following ,

At each node of the path , the next node is the one to which the flow of current is maximum.

Inspiration for the problem :-

A person moves in a city from point A to point B which are connected by various roads. Assuming he always takes that path which has less "traffic "(resistance) , what will be his path in a traffic scenario with the conditions of the roads given(resistance). The roads conditions(resistance) worsen with time proportional to their usage.

Approach to the problem :-

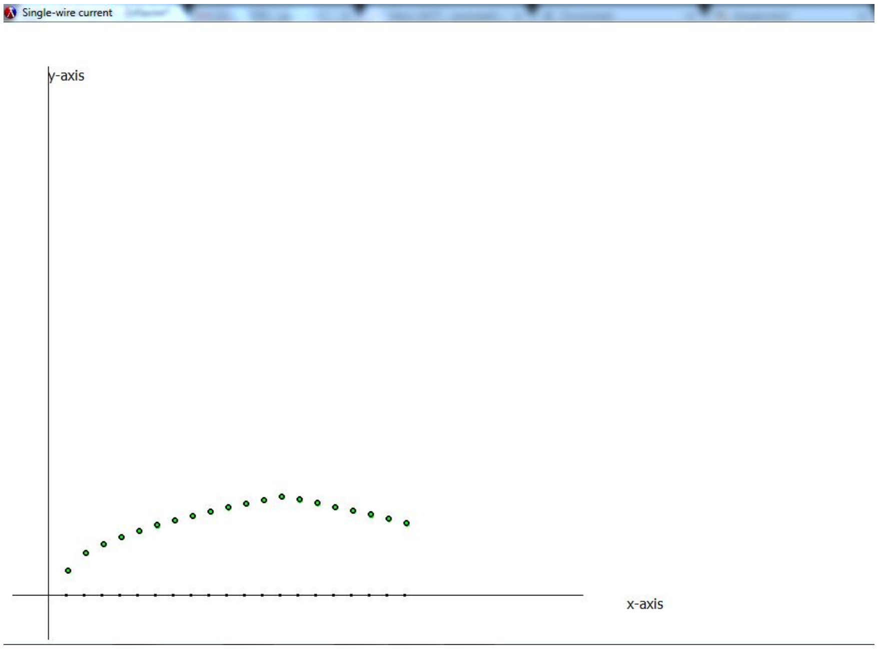
We will first get linear equations between voltages at different nodes using Kirchoff's laws. Then we solve them to get the voltages and hence current in each wire , min-path above defined. The linear equations are solved by Guass-Jordon method which is suited for list structures.

Entities used in the program :-

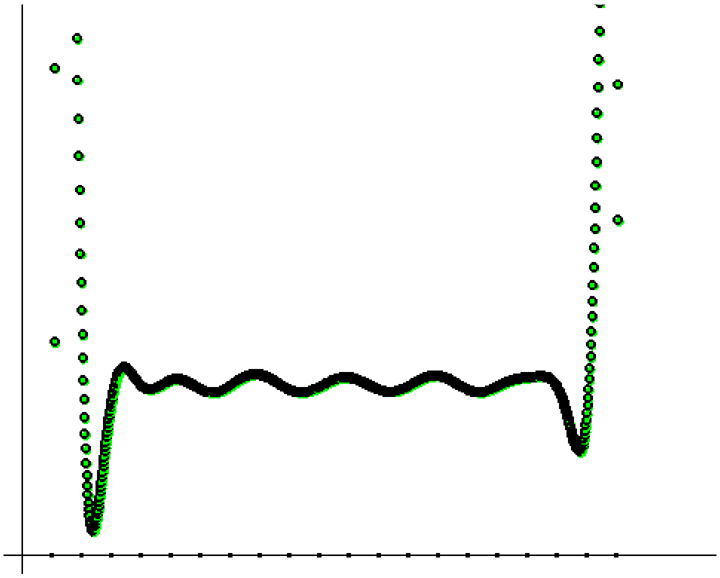
We made a circuit object consisting of object wire. There is a combine function in circuit object which makes a bigger circuit object from smaller ones. There are two solve function depending on the way we want to solve a circuit. There is a function which generates curve passing through N given points(polynomial approximation) , this is used to get continuous variation of required things(current , effective resistance .....) with time. There is a variation of the code given in Major Assignment-2 which gives motional graphs.

Sample Input :-

```
> (define a (polygonal 2 10 0))  ;;it is a wheat-stone bridge

> (effective-res a 2 4)

10.0

  > (define d (grid 3))

> (send d solve-two 1 8)

> (shortest-path  1 8 d)

(hold

 '(1 4 6 8)

 (list

  (object:wire% ...)

  (object:wire% ...)

  (object:wire% ...)))

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

> (define d (polygonal 3 5 2))

> (send d solve)

> (effective-res d 1 3)

8.928571428571429

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

> (send d show-current 1 2 5 2)

2 (4/5)

;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

(define a (polygonal 2 10 0))

(for-loop1 20 a 1 3 f1 1 0)

'((20 36.797937950800765)

  (19 41.605047044685286)

  (18 45.95694629245643)

  (17 49.960137811921676)

  (16 53.68553602542349)
  (15 49.6579864991576)

  (14 45.23680807105416)

  (13 40.2703784609093)

  (12 34.46787374335093)

  (11 27.08323025226349)

  (10 33.12158806340314)

  (9 38.33830304812588)

  (8 42.9904942685953)

  (7 47.22549488601064)

  (6 51.13658877751301)

  (5 46.86941356006104)

  (4 42.12121212121212)

  (3 36.666666666666664)

  (2 30.0)

  (1 10))

;;;;;;;;;;;;;;;;;;;;test-case-1

(define a (polygonal 2 10 0))

(for-min-path 20 a 2 4 total-resis 2 'motional)
```



```
;;;;;;;;;;;;;;;;;;;;test-case-2

(define a (polygonal 2 10 200))

(for-wire-current 20 a (make-object wire% 1 2 10 200) 1 'static)
```



Limitations :-

1. Our matrix algorithm(Guass-Jordan) doesn't account for symmetry in circuit.
2. The polynomial approximation is not a good if many point are taken.