

Root Squaring for Root Finding

ABSTRACT

We use root squaring to approximate the root radius of polynomials.

CCS CONCEPTS

• Computing methodologies → Hybrid symbolic-numeric methods.

KEYWORDS

symbolic-numeric computing, root finding, polynomial algorithms, computer algebra

ACM Reference Format:

. 2018. Root Squaring for Root Finding. In *Proceedings of Make sure to enter the correct conference title from your rights confirmation email (Conference acronym 'XX)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/XXXXXXX.XXXXXXX>

1 INTRODUCTION

2 RELATED WORKS

3 BACKGROUND

4 MOTIVATING EXAMPLE

5 ALGORITHM DESIGN

Algorithm 1 circ_roots_rational_form(p, q, l)

```

 $r, s := \text{angle\_sq\_root}(p, q)$ 
 $t, u := \text{angle\_neg}(r, s)$ 
if  $l == 1$  then
    return  $[(r, s), (t, u)]$ 
else if  $l != 0$  then
     $\text{left} := \text{circ\_roots\_rational\_form}(r, s, l - 1)$ 
     $\text{right} := \text{circ\_roots\_rational\_form}(t, u, l - 1)$ 
    return  $\text{left} \cup \text{right}$ 
else
    return  $[(p, q)]$ 
end if

```

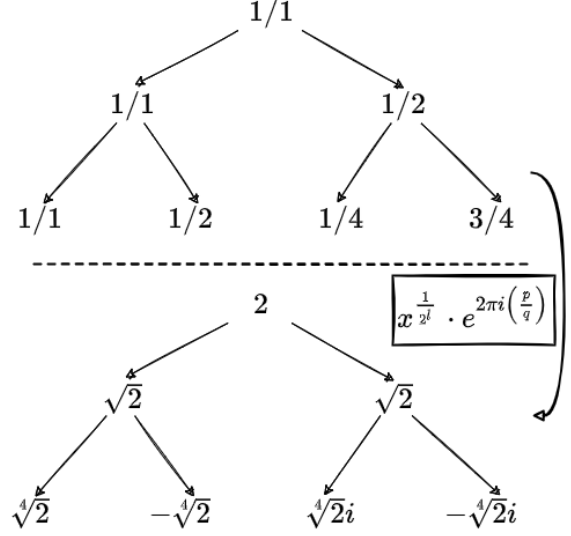


Figure 1: The steps of circ_roots_rational_form(p, q, l) in Alg. 1.

Algorithm 2 angle_sq_root(p, q)

```

if  $p \% q == 0$  then
    return  $(1, 1)$ 
else
    return  $(p, 2q)$ 
end if

```

Algorithm 3 angle_neg(p, q)

```

if  $p \% q == 0$  then
    return  $(1, 2)$ 
else
    return  $(2p + q, 2q)$ 
end if

```

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Conference acronym 'XX, June 03–05, 2018, Woodstock, NY

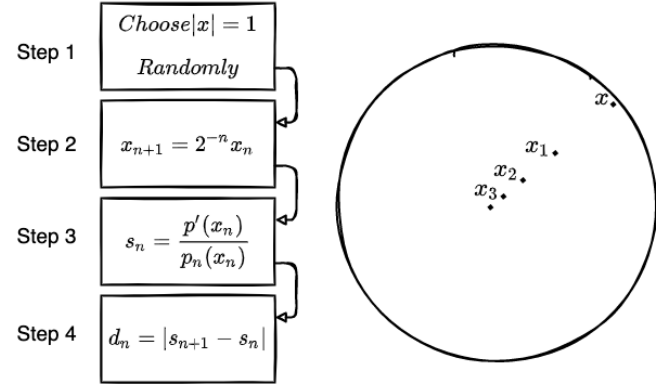
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ACM ISBN 978-1-4503-XXXX-X/18/06...\$15.00
<https://doi.org/XXXXXXX.XXXXXXX>

Algorithm 4 DLG_rational_form(p, p', r, t, u, l)

```

root := roots( $r, t, u, l$ )
for  $r_i \in \text{root}$  do
  base_step[ $i$ ] :=  $\frac{p'(r_i)}{p(r_i)}$ 
end for
diff[0] := base_step
for  $i \leq l$  do
  for  $j \leq 2^{l-i-1}$  do
    diff[ $i+1$ ][ $j$ ] :=  $\frac{1}{2} \frac{\text{diff}[i][2j] - \text{diff}[i][2j+1]}{\text{root}[2j]}$ 
    root = roots( $r, t, u, l-1-i$ )
  end for
end for
return derivs[ $l$ ][0]

```

6 THEORETICAL ANALYSIS**7 EXPERIMENTAL RESULTS****Figure 2: Limit test.****8 CONCLUSION****REFERENCES**