[VA] SRC#003- New Year 2019 Special

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01-28-2019, 09:34 PM **Post: #21**

pier4r
Senior Member

Posts: 1,963
Joined: Nov 2014

RE: [VA] SRC#003- New Year 2019 Special

> **Albert Chan Wrote:** ⇨ (01-28-2019 02:46 PM)
> I PM Thomas last week for how his estimated iterations work.
> Sadly, I still don't understand the geometric intuition ...

I know that is difficult to gauge whether a question is of general interest, but such explanations may help many (also those future readers!) and not only you, so if I were you I would ask in the public thread rather than in PM.

Wikis are great, Contribute :)

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01-29-2019, 01:43 AM **Post: #22**

rprosperi
Senior Member

Posts: 3,280
Joined: Dec 2013

RE: [VA] SRC#003- New Year 2019 Special

> **Thomas Klemm Wrote:** ⇨ (01-28-2019 08:17 PM)
> Maybe this video can give some geometric intuition:

Awesome Video Thomas, thanks for recommending it and the link! I certainly never learned Eigenvectors and Eigenvalues from this perspective, and it provides MUCH clarity for the mechanics underlying the number-crunching techniques I was taught. Having a better "feel" of what's going on, as this video provides, gives one much better insight into how to resolve issues when the 'normal equations/tools' don't work.

I will also check out some other videos in the same series. I'm always eager to learn stuff that's well presented, even if it is re-learning stuff I already supposedly know.

--Bob Prosperi

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01-29-2019, 01:59 AM **Post: #23**

Thomas Klemm
Senior Member

Posts: 1,449
Joined: Dec 2013

RE: [VA] SRC#003- New Year 2019 Special

> **rprosperi Wrote:** ⇒ (01-29-2019 01:43 AM)
> I will also check out some other videos in the same series.

I bet you will like: Visualizing quaternions
An explorable video series

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01-29-2019, 04:04 AM **Post: #24**

rprosperi
Senior Member

Posts: 3,280
Joined: Dec 2013

RE: [VA] SRC#003- New Year 2019 Special

> **Thomas Klemm Wrote:** ⇒ (01-29-2019 01:59 AM)
> > **rprosperi Wrote:** ⇒ (01-29-2019 01:43 AM)
> > I will also check out some other videos in the same series.
>
> I bet you will like: Visualizing quaternions
> An explorable video series

Thanks, I'll check these out as well.

After the original above, I stumbled onto this video, with the first explanation of Euler's Identity I can honestly say I understood. So, while it now has a tiny bit less magic, it's still beautiful, and I can say I understand it.

--Bob Prosperi

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02-08-2019, 08:46 PM **Post: #25**

Albert Chan
Senior Member

Posts: 624
Joined: Jul 2018

RE: [VA] SRC#003- New Year 2019 Special

Tried doing √3 with this matrix power method, noticed a pattern:
let M = {{1,3}, {1, 1}}

M^2 = {{3*1+1, 3*(1+1)}, {1+1, 3*1+1}} = {{4,6}, {2,4}}
M^3 = {{3*2+4, 3*(2+4)}, {2+4, 3*2+4}} = {{10,18}, {6,10}}

Right diagonal ratio stayed at 3.0, and left diagonal same numbers.
-> only need to do bottom row. Top row can be deduced if needed.
-> each matrix multiply required only 2 add, and 1 multiply

row 2 of M^4 = {6+10, 3*6+10} = {16, 28}
row 2 of M^5 = {16+28, 3*16+28} = {44, 76}
row 2 of M^6 = {44+76, 3*44+76} = {120, 208} ...

Doing the average of ratios, for M^6: √3 ~ ½(208/120 + 360/208) ~ ½(1.733333 + 1.730769) = 1.732051

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02-08-2019, 11:36 PM **Post: #26**

Albert Chan
Senior Member

Posts: 624
Joined: Jul 2018

RE: [VA] SRC#003- New Year 2019 Special

> **Albert Chan Wrote:** ⇨ (02-08-2019 08:46 PM)
> Tried doing √3 with this matrix power method, noticed a pattern:
> let M = {{1,3}, {1, 1}}
>
> M^2 = {{3*1+1, 3*(1+1)}, {1+1, 3*1+1}} = {{4,6}, {2,4}}
> M^3 = {{3*2+4, 3*(2+4)}, {2+4, 3*2+4}} = {{10,18}, {6,10}} ...

To prove that the ratio converge to √3, noticed above actually does Farey Fraction:

M^1: √3 between 1/1 and 3/1, so (1+3)/(1+1) = 4/2 is better estimate.
M^2: √3 between 4/2 and 3/(4/2) = 6/4, so (4+6)/(2+4) = 10/6 is better estimate
M^3: ...

Newton's method, does the same thing, but converge faster: x = ½(x + 3/x)

1: ½(1/1 + 3*1/1) = 2/1 = 2
2: ½(2/1 + 3*1/2) = 7/4 = 1.75
3: ½(7/4 + 3*4/7) = 97/56 ~ 1.732143
4: ½(97/56 + 3*56/97) = 18817/10864 ~ 1.73205081

The fractions are so good that all above (and at least 6 more !) are √3 continued fraction convergents.

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02-09-2019, 03:55 AM (This post was last modified: 02-09-2019 04:41 AM by Albert Chan.) **Post: #27**

Albert Chan
Senior Member

Posts: 624
Joined: Jul 2018

RE: [VA] SRC#003- New Year 2019 Special

The idea of only doing only *last* row work for 3x3 matrix too. 

Let M = {{k, n, n}, {1, k, n}, {1, 1, k}}

-> M^p = {{c, n*a, n*b},
{b, c, n*a},
{a, b, c}}, for some a, b, c

-> For M^(p+1), **last row = {k*a+b+c, n*a+k*b+c, n*a+n*b+k*c}**

Example: this is result of M^200 last row ratios:

Code:

```
lua> k, n = math.pi, 2019
lua> a, b, c = 1, 1, k
lua> for i=2,200 do
```

```
:       a, b, c = (k*a+b+c)/n, a+(k*b+c)/n, a+b+k*c/n
:    end
lua> =a, b, c
2.916424658351884e-212  3.686063969271537e-211  4.658809733574611e-210
lua> =b/a, c/b
12.638982319380704      12.638982319385288
```

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