# Visualizing the escape paths of quaternion fractals

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**Abstract**

The escape paths of the points in some quaternion fractal sets are visualized using OpenGL. Source code is provided.

## 1 Escape paths

The notion that the escape paths can make for nice visualizations was independently found by Paul Bourke [1]. Bourke's work was inspired by the Buddhabrot. The primary difference between Bourke's visualizations and the visualizations given here is that Bourke draws the paths for those points not in the set, where – oppositely – here we draw the paths for those points in the set.

Here we use Bezier curves to draw the escape paths. The length of these shaggy escape paths is shortened to only 20% of the total length, giving the impression of a isotropic buzzcut.

The C++/OpenGL code for this paper can be found at [2].

The following are images of the escape paths:
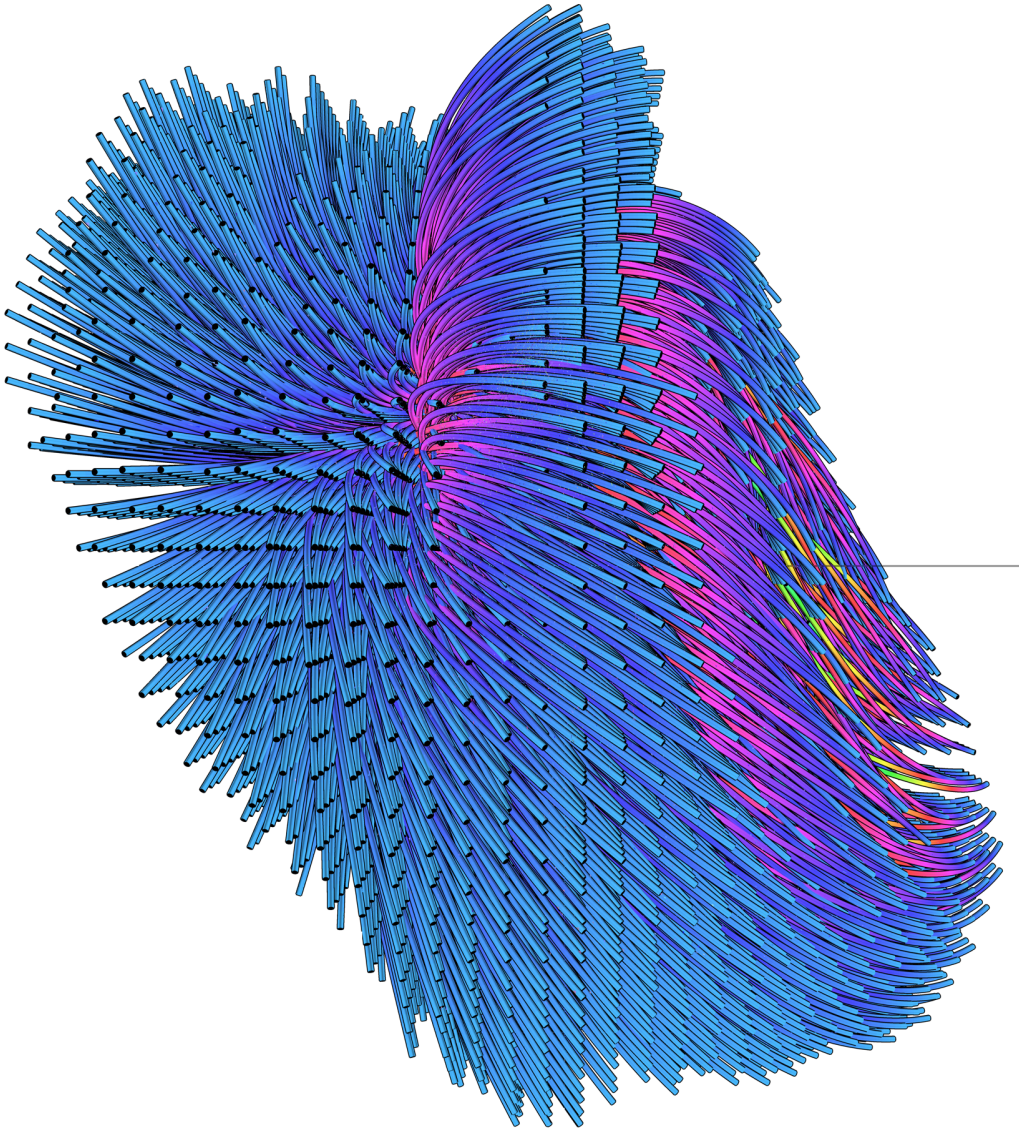
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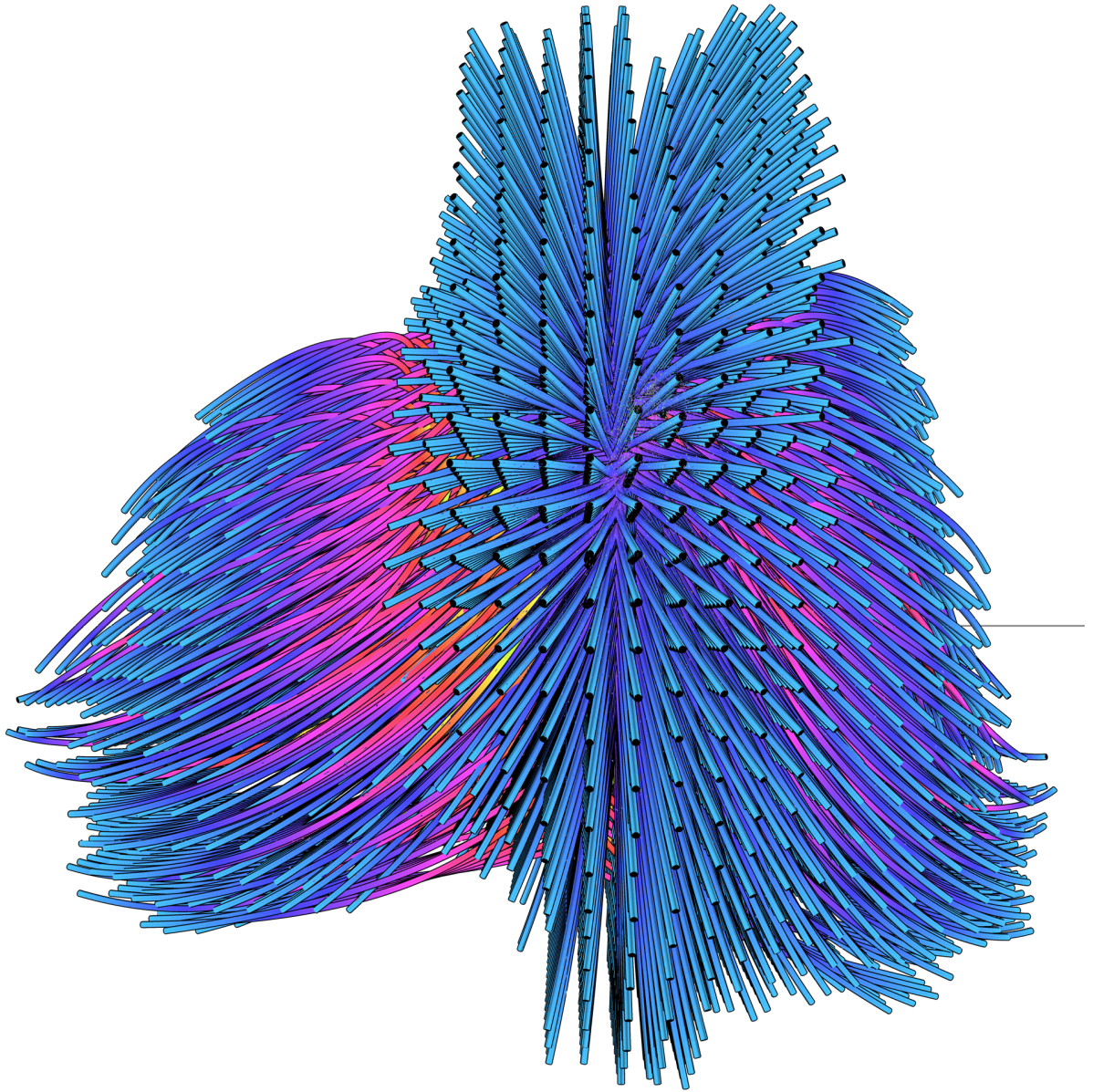Figure 1: $Z' = Z^2 + C$, where $C_{xyzw} = 0.3, 0.5, 0.4, 0.2$.

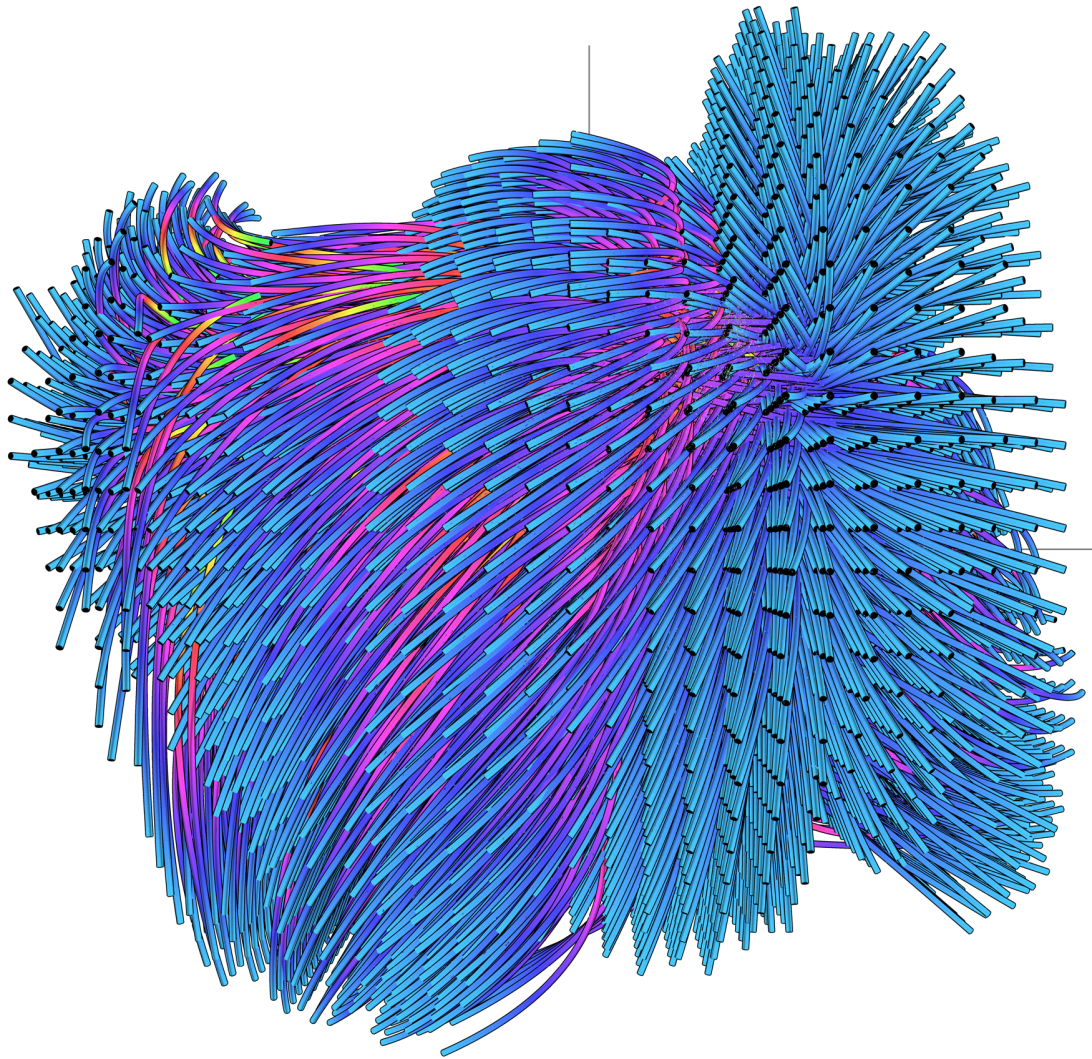Figure 2: $Z' = Z^3 + C$, where $C_{xyzw} = 0.3, 0.5, 0.4, 0.2.$

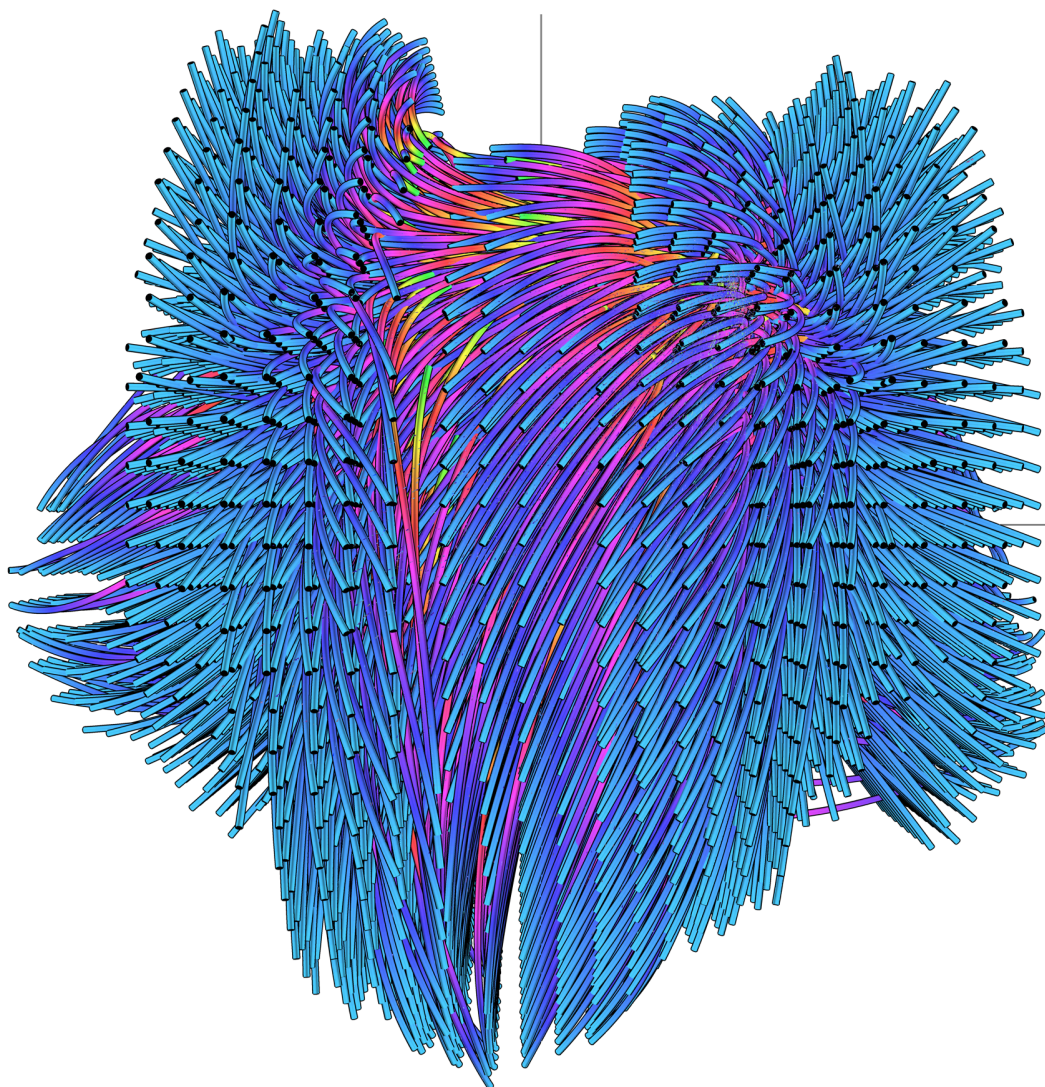Figure 3: $Z' = Z^4 + C$, where $C_{xyzw} = 0.3, 0.5, 0.4, 0.2$.

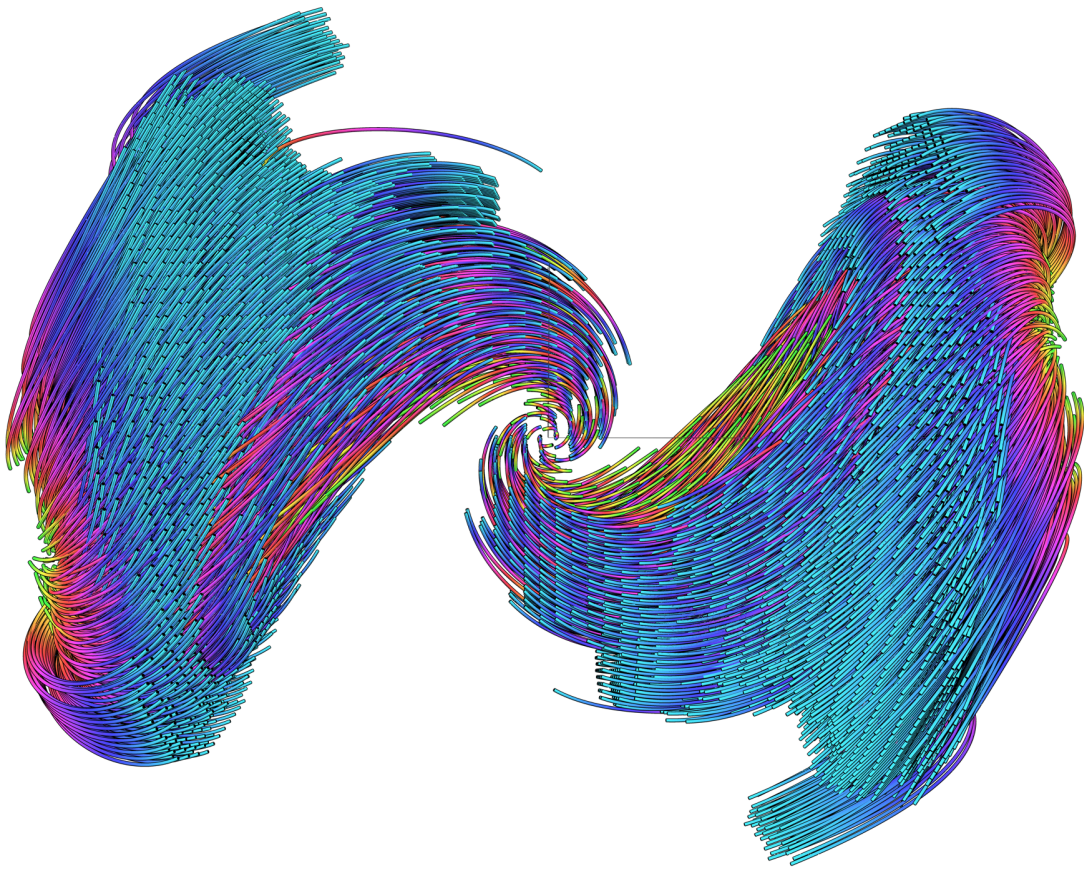Figure 4: $Z' = Z^5 + C$ , where $C_{xyzw} = 0.3, 0.5, 0.4, 0.2.$

Figure 5: $Z' = \sin(Z) + C \cdot \sin(Z)$, where $C_{xyzw} = 0.3, 0.5, 0.4, 0.2$.

# References

[1] http://paulbourke.net/fractals/trajectories/

[2] https://github.com/sjhalayka/bezier_fractal

[3] Halayka S. *Some visually interesting non-standard quaternion fractal sets* Chaos, Solitons & Fractals Vol. 41, Issue 5

[4] Halayka S. *Approximating the connectedness of 3D quaternion Julia sets via isosurface polygonization* Chaos, Solitons & Fractals Vol. 42, Issue 1