Dynamical Research Summer 2014
Singular, Non-Holomorphic Perturbations

1 Updates/Figures

1.1 Weekly Updates

7/6/2014:

- Working through the Bozyck/Peckham paper again for refresher
- Worked on the parameter space function and managed to get that to pump out images
- Starting using standard "spectral" color mapping, added colormap as parameter to functions
- Added a kind of general main function through which I can make phase or param space images
- Added a filename convention to keep track of what a given image is depicting
- Added some code to generate the latex snippet needed to add an image to a latex document
- Started a running work pdf to hold weekly updates along with archive-worthy images
- Starting to work on solving along the real axis

8/10/2014:

- Continuing work along the real axis
- Solved for fixed point with respect to c and β
- Made orbit diagrams for real case with c varying, may make β vary if useful
- Tried decomposing singular maps into maps of $\mathbb{R}^2$, not much success

1.2 Images

Figure 1: Parameter space image for param c with the equation $z^2 + 1 + \frac{0.000100000000000000}{\overline{z}^2}$

Figure 2: Parameter space image for param c with the equation $z^2 + 1 + \frac{0.0100000000000000}{\overline{z}^2}$

Figure 3: Phase space image of $z^2 + -1 + \frac{-0.00100000000000000}{\overline{z}^2}$

Figure 4: Phase space image of $z^2 + 1 + \frac{0.238000000000000}{\overline{z}^2}$

Figure 5: Phase space image of $z^3 + (0.49 + 0.049j) + \frac{-0.00100000000000000}{\overline{z}^3}$

Figure 6: Phase space image of $z^2 + 1j + \frac{(-0.6+0.1j)}{\overline{z}^2}$

Figure 7: Parameter space image for param c with the equation $z^2 + 0 + \frac{0}{\bar{z}^2}$

Figure 8: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.00990000000000000}{\bar{z}^2}$

Figure 9: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0198000000000000}{\overline{z}^2}$

Figure 10: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0297000000000000}{\overline{z}^2}$

Figure 11: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0396000000000000}{\overline{z}^2}$

Figure 12: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0495000000000000}{\overline{z}^2}$

Figure 13: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0594000000000000}{\overline{z}^2}$

Figure 14: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0693000000000000}{\overline{z}^2}$

Figure 15: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.07920000000000000}{\overline{z}^2}$

Figure 16: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.08910000000000000}{\overline{z}^2}$

Figure 17: Parameter space image for param c with the equation $z^2 + 0 + \frac{0.0990000000000000}{\overline{z}^2}$

Figure 18: Orbit Diagram for $z^2 + c + \frac{0.0001}{\overline{z}^2}$ where z and c are real

Figure 19: Orbit Diagram for $z^2 + c + \frac{0.001}{\bar{z}^2}$ where z and c are real

Figure 20: Zoom on orbit Diagram for $z^2 + c + \frac{0.01}{\bar{z}^2}$ where z and c are real

Figure 21: Orbit Diagram for $z^2 + c + \frac{0.01}{\bar{z}^2}$ where z and c are real

Figure 22: Fixed points for $z^2 + c + \frac{0.001}{\bar{z}^2}$ where z and c are real

Figure 23: Fixed points for $z^2 + c + \frac{0.01}{\bar{z}^2}$ where z and c are real

Figure 24: Fixed points for $z^2 + c + \frac{0.1}{\bar{z}^2}$ where z and c are real

Figure 25: A view of the fixed points for $z^2 + c + \frac{\beta}{\overline{z}^2}$ where z, c, and β are real

Figure 26: A view of the fixed points for $z^2 + c + \frac{\beta}{\overline{z}^2}$ where z, c, and β are real

2 Preliminary Write-Ups

2.1

2.2 Real Splines

As a way of restricting the scope of initial solution attempts, we will focus our attention on the dynamics of the real axis. Thus we have the following simplification:

$$x^d + c + \frac{\beta}{\overline{x}^n} \Rightarrow x^d + c + \frac{\beta}{x^n}$$

Then if we make the simplifying assumption that $n = d$ and choose different β values, we can start to solve for the fixed points of the system.

$\underline{d = 1}$

(AFTER ABOVE WORK) Thus we have begun to understand the dynamics of this system. However the above work only applies to the case where x is real, $n = d$, and $n = d$, and β are specific values.