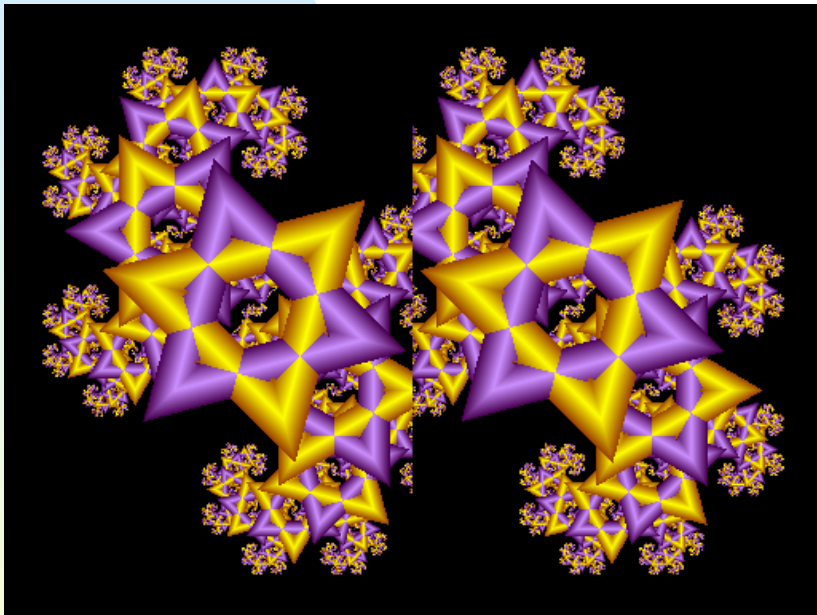


CSSE/MA 325 - Fractals and Chaotic Dynamical Systems



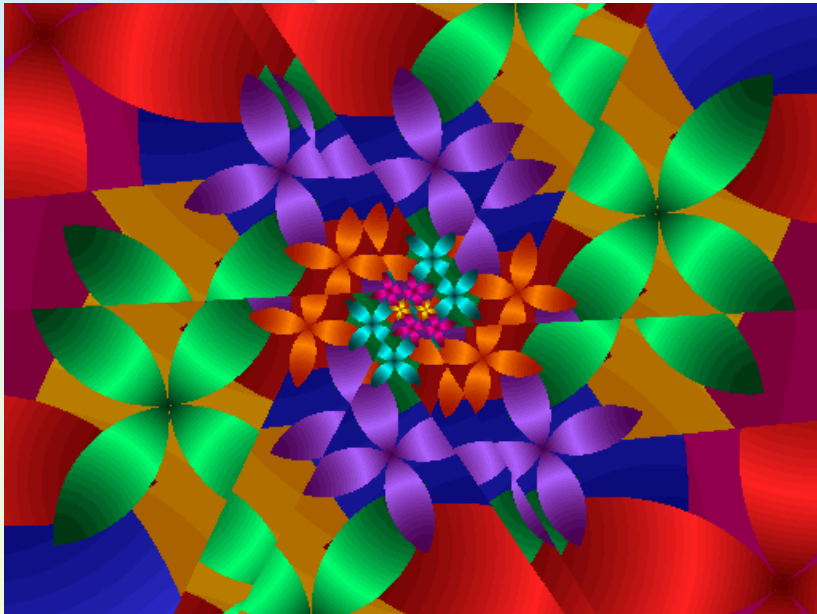
Matt Boutell

Department of Computer Science
and Software Engineering

Rose-Hulman Institute of
Technology

x8534, Moench F224

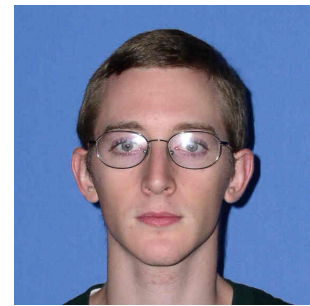
Agenda: Introductions to



- The players
- The course structure
- The course material:
 - ◆ Informal definition of fractal
 - ◆ Video

The Key Players

- Instructor: Matt Boutell
- Course assistant: Jason Sauppe



- Role call:
 - ◆ Correct pronunciations, nicknames
 - ☞ Help me learn your names quickly
 - ◆ Your plans for the summer

More about me



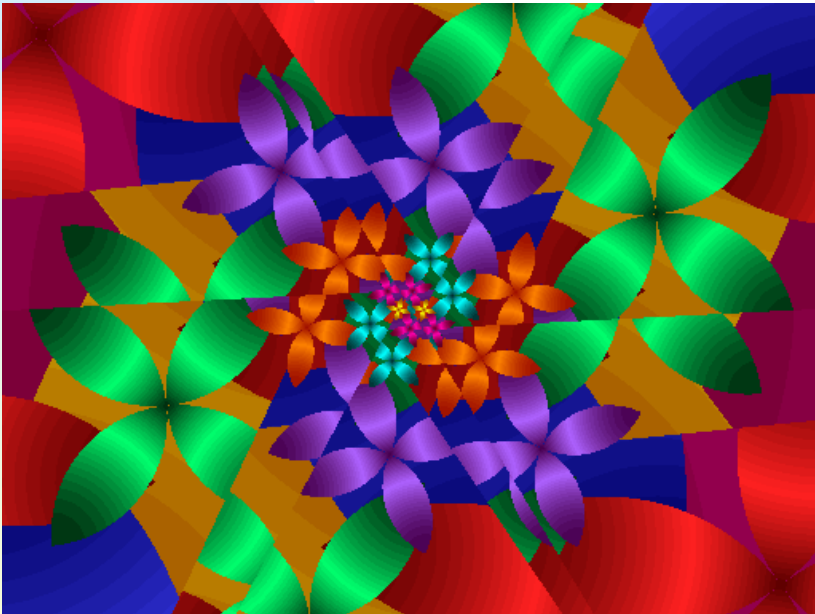
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March 3, 2008



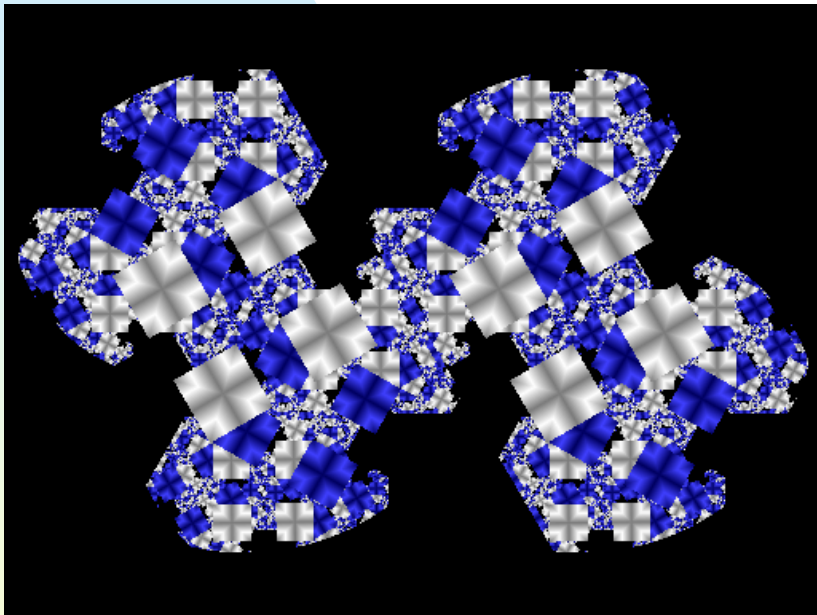
CSSE/MA 325 Lecture #1

Agenda: Introductions to



- The players
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- The course material:
 - ◆ Definition of fractal
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Course organization

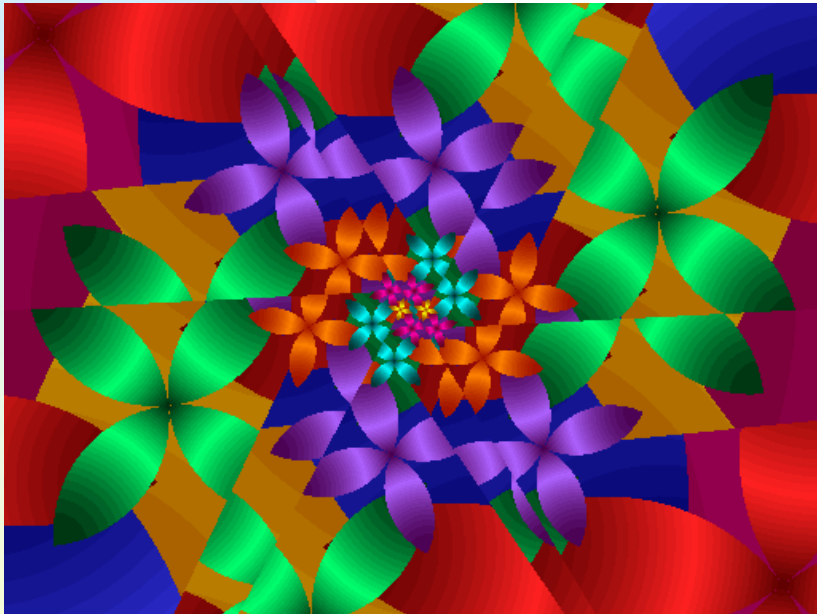


- Text is *Chaos and Fractals: New Frontiers of Science (Second Edition)*
 - ◆ *Peitgen, Jurgens, and Saupe (PJS)*
- Course will consist of lectures, daily quizzes, discussions, readings, computer projects, and written homework; no exams
 - ◆ Materials borrowed heavily from the 2006 version taught by Dr. Cary Laxer

Angel merged website

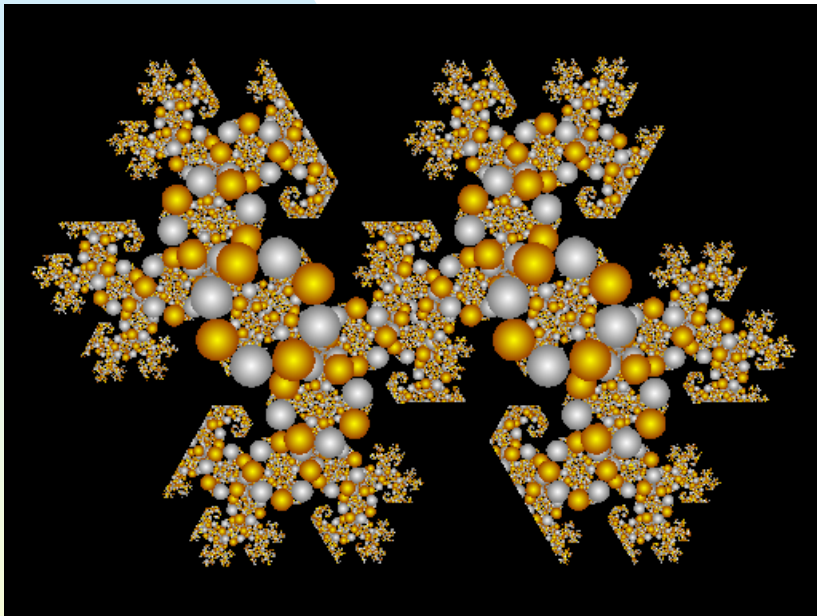
- Syllabus:
 - ◆ Grading, attendance, academic integrity
- Schedule:
 - ◆ See HW/Reading due tomorrow and Thursday

Agenda: Introductions to



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A new geometry for nature



- In studying nature, Mandelbrot recognized that Euclidean geometry was not sufficient to describe the shapes nature provided
 - ◆ mountains are not cones
 - ◆ clouds are not spheres
 - ◆ coastlines are not circles
- Mandelbrot developed a new geometry of nature that described the irregular and fragmented patterns around us

Fractal



- The term *fractal* was coined by Mandelbrot
- It is derived from the Latin adjective *fractus*, which comes from the verb *frangere*, meaning “to break”, to create irregular fragments



Random fractals

- Arose from the study of nature
- Display a certain statistical similarity across scale
- Random fractal models simulate these statistical properties, creating patterns that can be rendered realistically as mountains, clouds, and rivers, which combine to make entirely synthetic planets (remember the Genesis planet from *Star Trek 2: The Wrath of Kahn*?)
- The most common random fractal model is fractional Brownian motion

Linear deterministic fractals

- Are composed of smaller copies of the whole
- The copies may be distorted, but only up to a linear distortion (squashing, shearing)
- Commonly modeled by sets of affine functions, such as iterated function systems, or sets of rules, such as L-systems
- Examples include the Koch snowflake, Sierpinski's gasket, Menger's sponge, and the Spleenwort fern



Non-linear deterministic fractals

- Are composed of vastly distorted copies of themselves
- Unlike linear fractals, non-linear fractals are usually modeled from a single function
- Examples include the Mandelbrot set and Julia sets

Video

- Watch the Genesis planet scene from *Star Trek II: The Wrath of Kahn* (1982)
- Pay attention to the quality of the plants

Homework

- See schedule page
- Opportunity for bonus points