CMSC427 Fall 2020
Notes on procedural textures

Procedural textures are 2D or 3D functions that produce 2D or 3D images that can either be animations in their own right, or serve as textures for surfaces. Karl Sims has been important in promoting these:

https://www.karlsims.com/seven.html

They can be used to model real world textures, so as to make artificial versions of sand, wood, marble, zebra hide, and more. Or, they can be used to make fantastical textures not found in life.

There's many algorithms, and we can't cover all. New ones are appearing, frequently based on neural nets. We have covered Mandelbrot sets, which with related equations (like Julia) are often used. The general ideas we'll review will be:

1) Combing normal functions to create textures (arithmetic ops, mod, min, max, abs, log, cos, etc). See Karl Sim's 1991 article, link below.

2) Harnessing noise, including Perlin noise.
See Perlin's original article:
http://www.heathershrewsbury.com/dreu2010/wp-content/uploads/2010/07/AnImageSynthesizer.pdf

3) Using multiple resolutions to create more natural textures, including the concepts of white, pink and brown noise.
See PowerPoint for lecture, and Mount's lecture, plus this link:
https://www.scratchapixel.com/lessons/procedural-generation-virtual-worlds/procedural-patterns-noise-part-1/introduction

4) Genetic algorithms for evolving interesting textures.
Not strictly a procedural texture technique – of more general application – but can be put to good use here. See Karl Sim's 1991 paper

Lecture outline:

I. Introduction to basics of procedural textures

This link gives a good introduction to the concepts.
http://www.upvector.com/?section=Tutorials&subsection=Intro%20to%20Procedural%20Textures

II. Evolutionary textures. From Karl Sims 1991. The 1991 paper illustrates combination of texture by combination of math functions, plus a genetic algorithm to evolve interesting patterns

Example:
https://www.karlsims.com/seven.html

The original paper is at this link but the images did not scan well:
http://www.vasulka.org/archive/ExhFest10/SIGGRAPH/SIG003.pdf

An online version with color images is here:
https://www.karlsims.com/papers/siggraph91.html

III. Shaping textures by combining multiple resolutions

This idea is discussed in the Mount lecture, the PowerPoint, and the first link on this page.

IV. Perlin noise

This is covered in the Mount lecture notes, the PowerPoint, and the following link:

https://www.scratchapixel.com/lessons/procedural-generation-virtual-worlds/procedural-patterns-noise-part-1/introduction