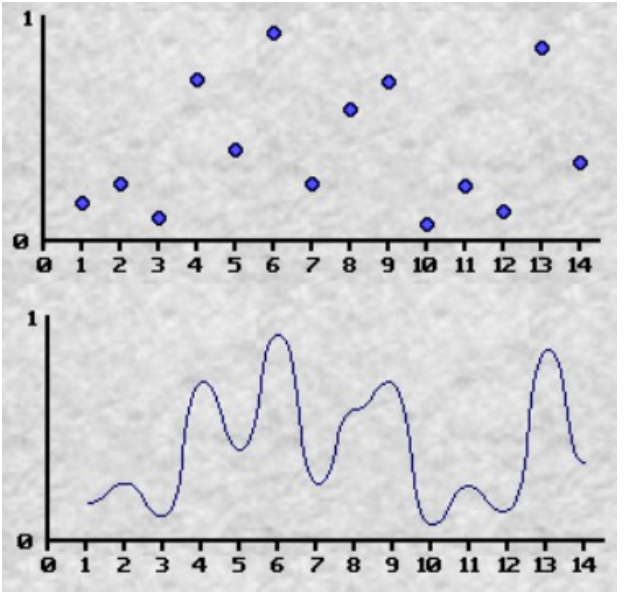
Modelovacie a renderovacie techniky

Úloha 3

Zuzana Berger Haladová

Úloha 3

- Perlin Noise
- Natural motion, behavior, textures …
- Fire, Smoke, Clouds, Terrain



- Pseudorandom, repeatable
- Limited range and band
- Non-periodic, irregular
- Continuous domain

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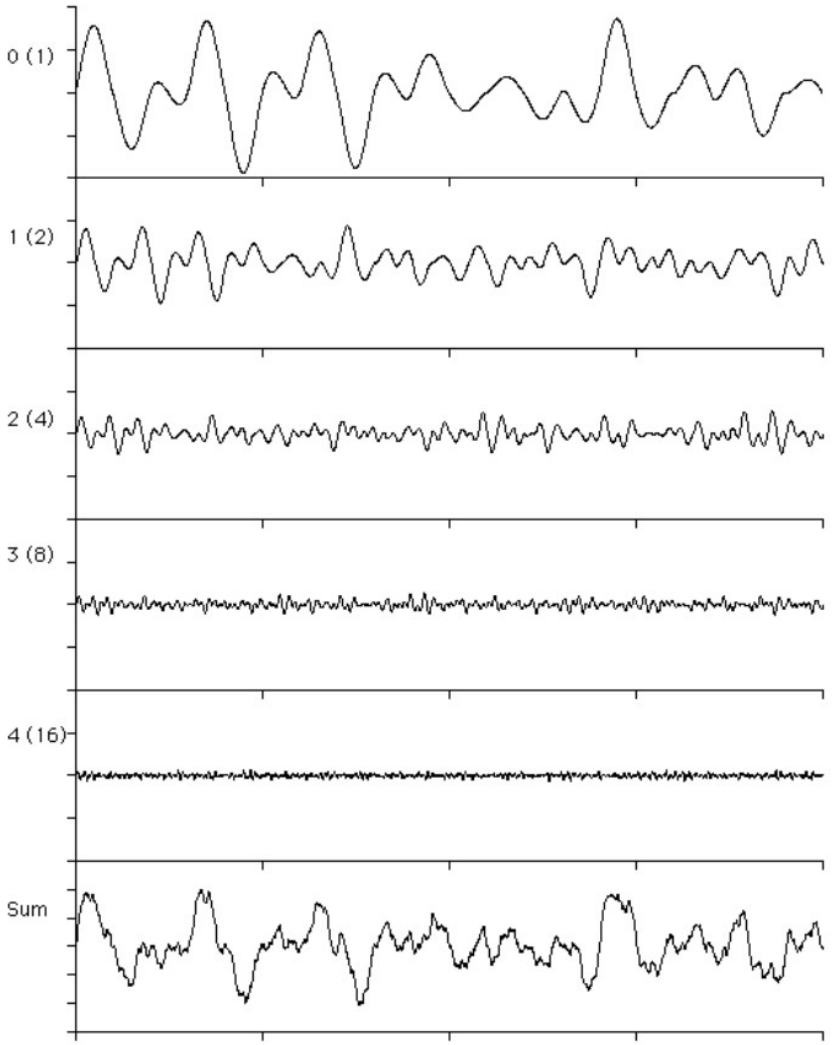
$$NOISE(\mathbf{x}) = \sum_{i=0}^{N-1} \frac{Noise(b^i \mathbf{x})}{a^i}$$

- Amplitude ~ a (value scaling)
  - a > 1
- Frequency ~ b (harmonic scaling)
  - b > 1



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- Regular grid
  - resolution of highest frequency (256x256)
- Random distribution of vectors
- Compute noise from vectors
- Interpolated to obtain values in between the lattices

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- Random field of vectors
- Options :
  - Compute and store whole field
  - Smaller field with pseudorandom access

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- Generate in Cartesian coordinates
  - Non-uniformly distributed

- Generate in Polar coordinates
  - Uniformly distributed
  - Convert to Cartesian
    - Random angle theta, r=1
    - vector=(cos(theta),sin(theta));

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- Random permutation of field 0,..,255
  - unsigned char permutation [256]
  - size = 256, 2^n
  - mask = 255 (Size -1)

- Index(int x, int y)
  - Perm(x + Perm(y))
- Perm(int x)
  - permutation[x & maska]
  - x & mask = x mod mask

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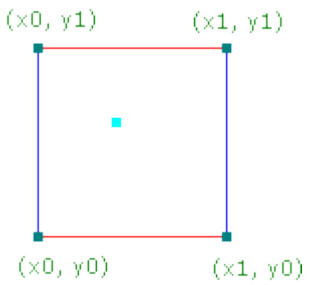
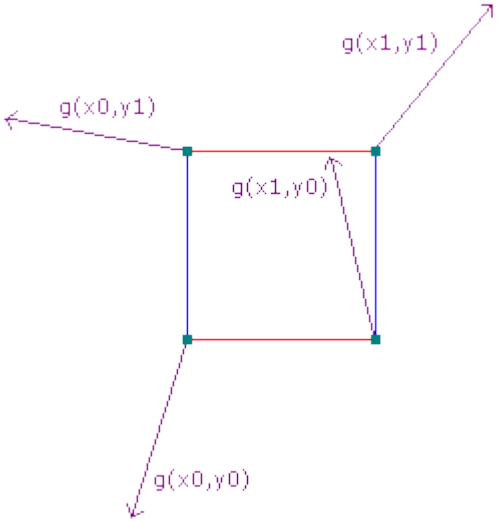
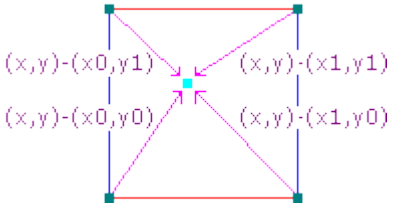
- Regular grid of vectors







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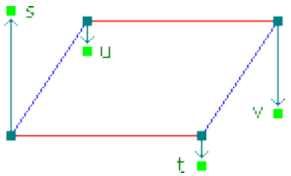
$$s = g(x_0, y_0) \cdot ((x, y) - (x_0, y_0))$$
$$t = g(x_1, y_0) \cdot ((x, y) - (x_1, y_0))$$
$$u = g(x_0, y_1) \cdot ((x, y) - (x_0, y_1))$$
$$v = g(x_1, y_1) \cdot ((x, y) - (x_1, y_1))$$



- Bilinear interpolation
  - Smoothness function

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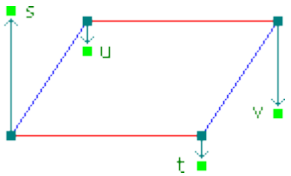
Smoothness function

$$smooth(t) = 3t^2 - 2t^3$$

Interpolation



$$S_x = smooth(x - x_0)$$
$$a = s + S_x(t - s)$$
$$b = u + S_x(v - u)$$

$$S_y = smooth(y - y_0)$$
$$noise = a + S_y(b - a)$$

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- Sum noises
  - with different amplitudes and frequencies (sliders)
  - b *= freq;
  - a *= amp;
  - 1D example
  - 2D – Noise(I,J) -> (I*=freq; J*=freq)

$$\mathrm{NOISE}(\mathbf{x}) = \sum_{i=0}^{N-1} \frac{\mathrm{Noise}(b^i \mathbf{x})}{a^i}$$

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- Scale from interval (-SMA,SMA) to (0,255)
- SMA= Sum of max possible amplitude
- e.g
- Map to texture pallet
  - Read first row from texture
  - FreeImage
    - FreeImage_GetPixelColor
    - FreeImage_SetPixelColor

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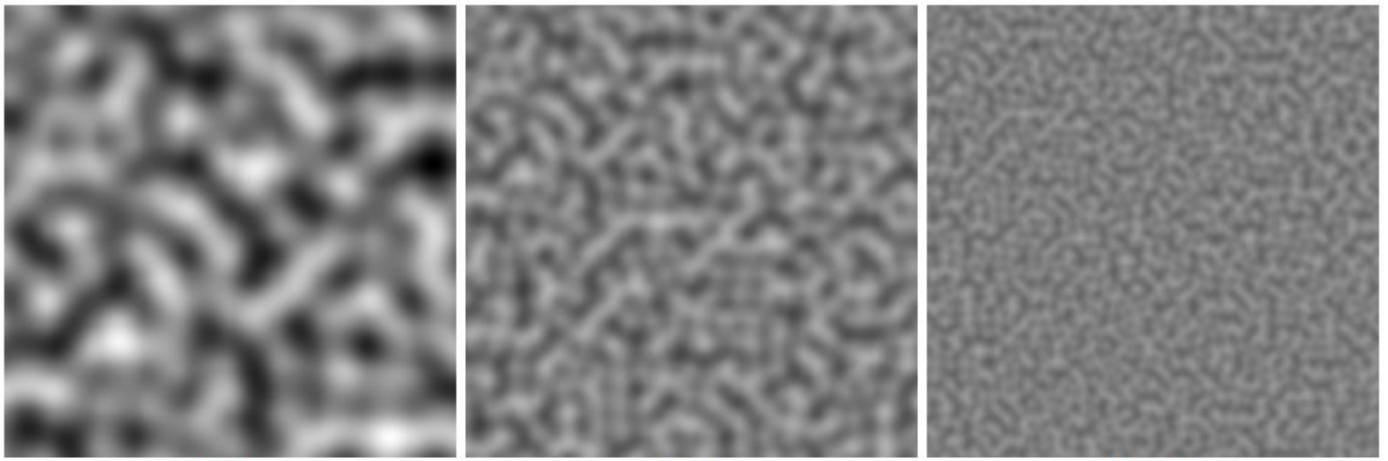
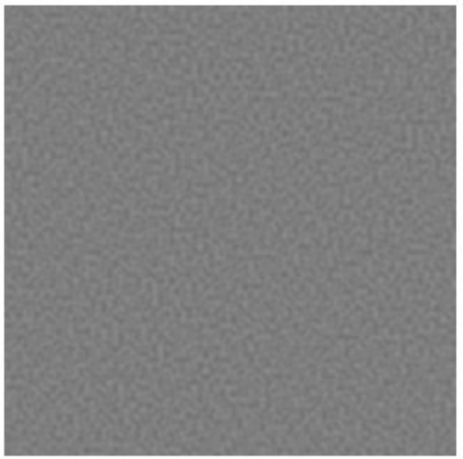


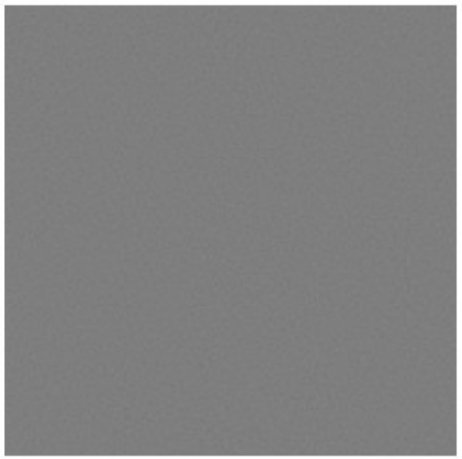
0 (1)

1 (2)

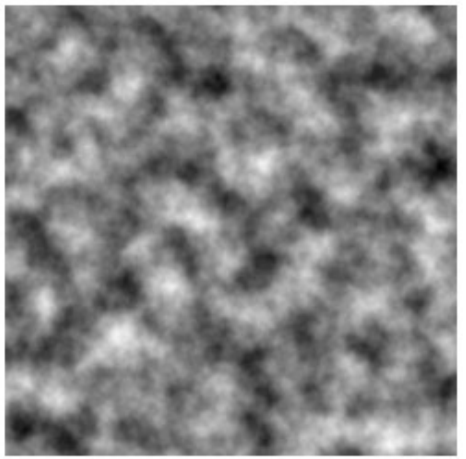
2 (4)



3 (8)



4 (16)



Sum

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- Perlin Noise generator
  - Generate 2D noise
  - Sliders to control frequency and amplitude
  - Apply on palette
    - Clouds, Wood, Marble …

http://freespace.virgin.net/hugo.elias/models/m_perlin.htm

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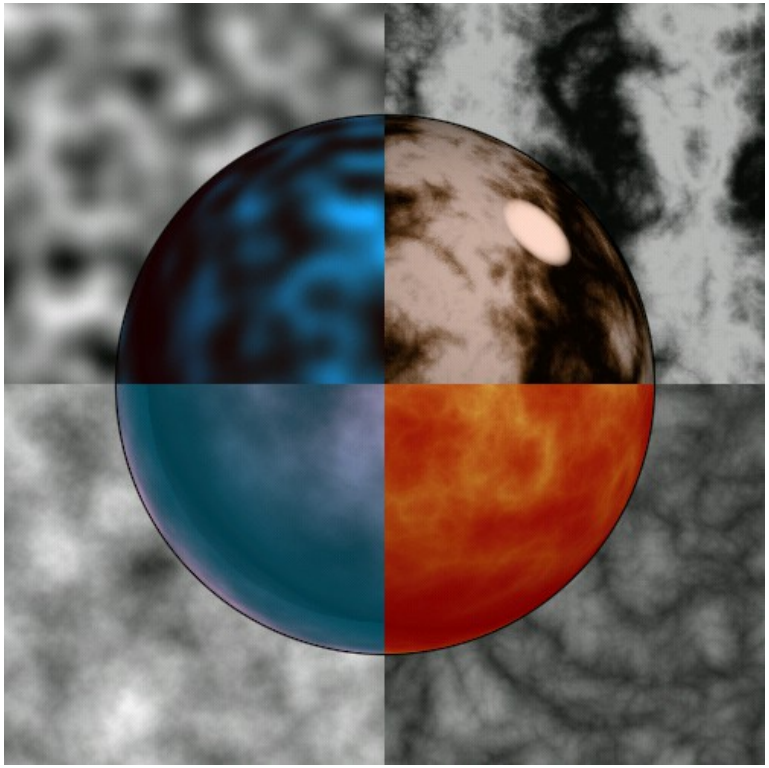

- Deadline
  - 11.12.2014 23:59
- Executable version + source code
- Sample application, compiled library VS2010