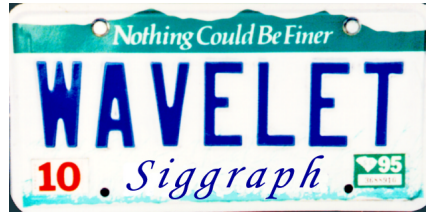


SIGGRAPH 96 Course

Wavelets in Computer Graphics



Organizers:

Peter Schröder and Wim Sweldens

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Morning Schedule

Introduction

Basics

- Time Frequency Analysis
- Building Wavelets at Home

Applications

- Curve Editing, Painting and Image Query
David Salesin
-

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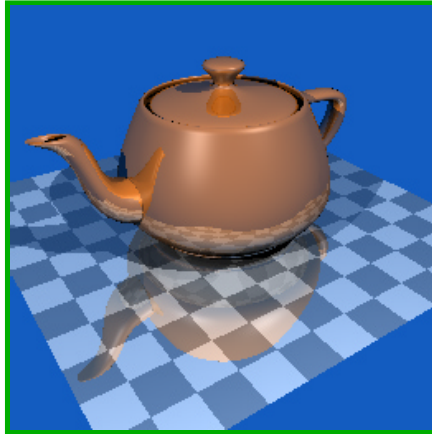
Afternoon Schedule

Applications:

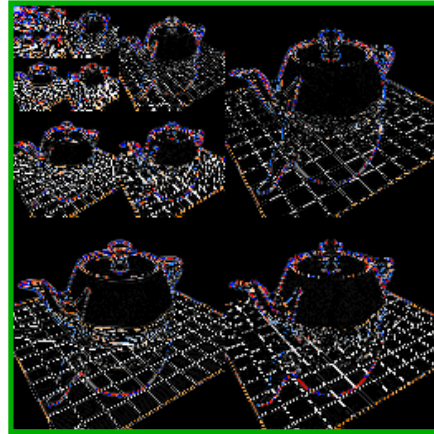
- Multiresolution Surfaces, Tony DeRose
 - Wavelet Radiosity, Peter Schröder
 - Spherical Wavelets, Wim Sweldens
 - Variational Modeling for Interactive Design
and Animation, Michael Cohen
-

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Wavelet Transform



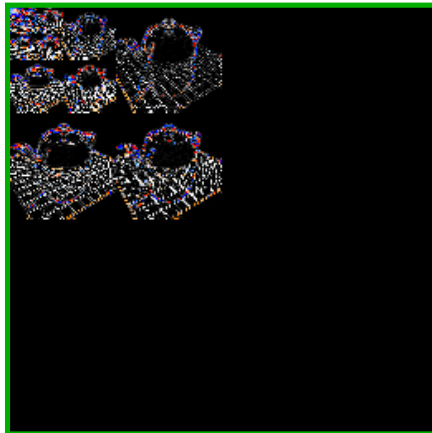
Original



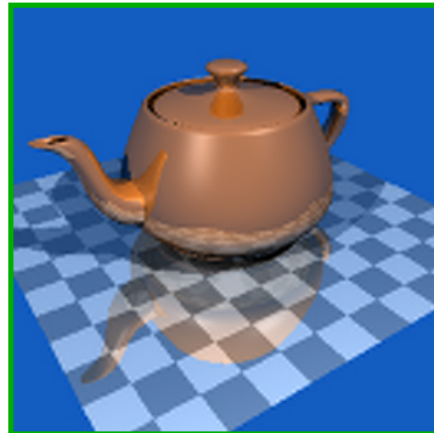
Transform

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Wavelet Transform



Erasing coefficients



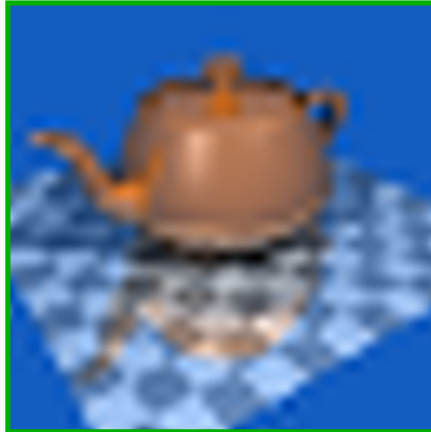
Reconstruction

6

Wavelet Transform



Erasing coefficients



Reconstruction

7

Wavelet Transform



Scaling up wavelet coeffs.



Attenuating wavelet coeffs.

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Why?

Dealing with complexity

- large databases
 - many pixels: image manipulation, bandwidth
 - many patches: modeling, rendering
 - many parameters: optimization, animation

Hierarchy

- level-of-detail
 - multiresolution
-

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Foundation

Observation

- most interesting data is not random

Exploit

- structure, coherence, correlation, smoothness

Result

- more compact representation
 - more efficient computations
-

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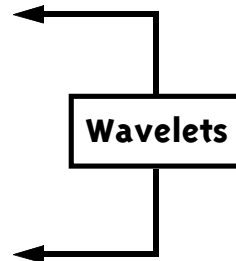
What?

Computational framework

- easy to implement
- fast: linear time
- wide applicability

Theoretical framework

- mathematical foundation
- analysis and error estimates



Where do Wavelets come from?

Many “parents”

- digital signal processing
 - filter banks
 - image compression
 - time frequency localization
 - physics
 - coherent states
-

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Where do Wavelets come from?

Many “parents”

- harmonic analysis
 - analysis of integral operators
 - numerical analysis
 - fast multigrid solvers for PDEs and integral equations
 - geometric modeling
 - subdivision
-

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History

Highlights

- 1911: Haar
 - 1930: Littlewood Paley
 - 1940: Gabor
 - 1960: Calderón-Zygmund
-

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History

Highlights

- 1984: continuous wavelet transform
 - 1985: subband coding
 - 1985: multiresolution analysis
 - 1988: orthogonal wavelets
 - 1990: biorthogonal wavelets
 - 1994: second generation wavelets
-

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Roadmap

Signals and their frequency contents

- Fourier
 - windowed Fourier: Gabor
 - Wavelet
-
-
-

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