Experiments in Mathematical Web Animation

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Mathematics and the Web – Sep 25, 2002

Outline

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Outline

- **Why animate? There is too much eye candy.**

Outline

- Why animate? There is too much eye candy.
- Graphics formats and conversions

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- Graphics formats and conversions
- Applications that can produce animations

Outline

- Why animate? There is too much eye candy.
- Graphics formats and conversions
- Applications that can produce animations
- Programming that can produce animations

Why Animate I: Sometimes time is part of the problem

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Why Animate I: Sometimes time is part of the problem

- Parametric equations, time dependent DE's

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- Parametric equations, time dependent DE's
- Data visualization of time dependent data

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- Data visualization of time dependent data
- Time series

Why Animate I: Sometimes time is part of the problem

- Parametric equations, time dependent DE's
- Data visualization of time dependent data
- Time series
- Are weather animations eye candy?

Why Animate II: Time as a dimension

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- **Using time as the 4^{th} dimension**

Why Animate II: Time as a dimension

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- **PDE solutions $u(x,t)$**

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- **PDE solutions $u(x,t)$**
- **$x^2 - y^2 + z^2 = C$, evolution on C**

Why Animate II: Time as a dimension

- **Using time as the 4^{th} dimension**
- **PDE solutions $u(x,t)$**
- **$x^2 - y^2 + z^2 = C$, evolution on C**
- **Should we bring back family of curves?**

Why Animate III: Time is the metaphor

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Why Animate III: Time is the metaphor

- limits

Why Animate III: Time is the metaphor

- limits
- homotopy

Why Animate III: Time is the metaphor

- limits
- homotopy
- algorithms

Why Animate III: Time is the metaphor

- limits
- homotopy
- algorithms
- Is zooming in on a numerical root eye candy?

Still Graphics Formats – Raster

Still Graphics Formats – Raster

- color for each pixel

Still Graphics Formats – Raster

- color for each pixel
- SIZE: height x width x color can be huge

Still Graphics Formats – Raster

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- Compression lossless vs lossy

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- Gif, Png (lossless): best for geometric figures

Still Graphics Formats – Raster

- color for each pixel
- SIZE: height x width x color can be huge
- Compression lossless vs lossy
- Gif, Png (lossless): best for geometric figures
- Jpg (lossy): best for photos.

Still Graphics Formats – Vector

Still Graphics Formats – Vector

- list of geometric primitives

Still Graphics Formats – Vector

- list of geometric primitives
- ps (Adobe) pagelayout – text

Still Graphics Formats – Vector

- list of geometric primitives
- ps (Adobe) pagelayout – text
- pdf (Adobe) pagelayout – compressed text

Still Graphics Formats – Vector

- list of geometric primitives
- ps (Adobe) pagelayout – text
- pdf (Adobe) pagelayout – compressed text
- dvi TEX pagelayout – binary

Still Graphics Formats – Vector

- list of geometric primitives
- ps (Adobe) pagelayout – text
- pdf (Adobe) pagelayout – compressed text
- dvi TEX pagelayout – binary
- SVG web(xml)based – text/binary

Animation Graphics Formats

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- **Animation – a sequence of still graphics (frames)**

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- **Speed fps (frames/second) $\geq$ 12, normal 24**

Animation Graphics Formats

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- Animated gifs – Raster

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- Mpeg, Quicktime: Film – need helpers – Raster

Animation Graphics Formats

- Animation – a sequence of still graphics (frames)
- Speed fps (frames/second) $\geq$ 12, normal 24
- Animated gifs – Raster
- Mpeg, Quicktime: Film – need helpers – Raster
- Swf (Flash Swift file) – Vector

Maple to create an animation

Maple to create an animation

- **Parametric equations**

Maple to create an animation

- Parametric equations
- Can export to html (with animated gifs)

Maple to create an animation

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- Can export to html (with animated gifs)
- Maple animation controls are lost

Maple to create an animation

- Parametric equations
- Can export to html (with animated gifs)
- Maple animation controls are lost
- Worst of both worlds, vector description but raster format

Bits 'n pieces to create 10000.gif

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- Binary data converted to ascii

Bits 'n pieces to create 10000.gif

- Binary data converted to ascii
- Ascii data use by gnuplot yielding a xpm file

Bits 'n pieces to create 10000.gif

- Binary data converted to ascii
- Ascii data use by gnuplot yielding a xpm file
- Converted xpm to gif (pbm, now convert)

Bits 'n pieces to create 10000.gif

- Binary data converted to ascii
- Ascii data use by gnuplot yielding a xpm file
- Converted xpm to gif (pbm, now convert)
- glued gif's to animated gif

Programming animation

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Programming animation

- Java program that cycles through frame files

Programming animation

- Java program that cycles through frame files
- Java/Javascript program that draws the frames

Programming animation

- Java program that cycles through frame files
- Java/Javascript program that draws the frames
- Flash (program)

Programming animation

- Java program that cycles through frame files
- Java/Javascript program that draws the frames
- Flash (program)
- Helper applications

Orbit 13

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Orbit 13

- **Illustration for a calculus project**

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Orbit 13

- Illustration for a calculus project
- A moon whose velocity is sometimes zero

Orbit 13

- Illustration for a calculus project
- A moon whose velocity is sometimes zero
- First attempt Maple

Orbit 13

- Illustration for a calculus project
- A moon whose velocity is sometimes zero
- First attempt Maple
- Second attempt Java SWF (Flash format)