Animations for Introductory Physics and Astronomy

The Animations for Introductory Physics and Astronomy project at Penn State Schuylkill was initiated to help students visualize aspects of 3-dimensional situations where traditional static drawings were seen as inadequate. The animations have been used to portray a wide variety of dynamical systems and processes for physics and astronomy topics typically presented in the advanced high school through introductory college level. Additional applications of the animation technology will be presented, including using more extensive animations for semester mini-themes and "What’s wrong" tasks using artificial video for video analysis. In addition, dissemination of the animations through the project web server at http://phys23p.sl.psu.edu/phys_anim/Phys_anim.htm and through the project YouTube channel at http://www.youtube.com/mrg3 will be discussed.
An (old) Example: Conical Pendulum

A 3-D dynamic situation sometimes mis-translated into 2-d static interpretation.
Incompressible Flow

\[ dV = \nu A \, dt \]
Two Source Interference
Looping Physics
Using The Looping Physics Animation

• Full Animation
  – 3 Minutes
  – Constant Speed, Failing at Constant Speed, Coasting, and Coasting Through Non-Circular
  – Some Physical Parameters Specified
  – Mini-Theme for Mechanics
    • Forces, Speed & Energy, Power Requirements, Impulse
      – “Can your car do this?”
Other Artificial Video Tasks

- Artificial Millikan Oil Drop for video analysis
  - Now, with fractional charges!
- “What’s Wrong with This Picture”
  - Free fall
  - Projectiles
Most Popular Video of Past Year (YouTube)

Longitudinal Wave
Some Reactions to Transvers/Longitudinal Wave Video

- OMG 25 SECONDS OF PURE GOODNESS I HAVE BEEN LOOKING FOR THIS FOREVER
- how on earth did this get dislikes?
- Finally! A video that simply explains how it works
- To the point~ most productive 25 secs of my life! (All these other online tutors need to start doing this!)
- Took me so long to find a video that was clear and made sense. Thanks!
- Very simple but helpful!

Related (older transverse/longitudinal wave videos):

- I added my own sound effects cause I found the silence awkward...
- I learned a 1-hour discussion in just 12 seconds. yey!
- who needs those useless 1 hour MIT lectures for waves when you got this, sriously!
- this 6 second video would have saved 3 physics classes..
- This 6 second video did a better job of explaining than my prof did in 2 hours...
Impact

YouTube Traffic

- **YouTube**
  - Over 3 Million video views channel wide

- **Project Server**
  - Almost 2 Million views on project server since July 2006
  - Static Catalog & CWIS portal

YouTube Demographics

- US: 27.4%
- India: 8.8%
- UK: 5.1%
- Brazil: 4.4%
- Canada: 3.5%
- Other: 39.3%
## Most Popular Videos (YouTube)

<table>
<thead>
<tr>
<th>Video views (lifetime)</th>
<th>Views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse and Longitudinal Waves</td>
<td>226,117 (7.4%)</td>
</tr>
<tr>
<td>Lenz's Law</td>
<td>195,333 (6.4%)</td>
</tr>
<tr>
<td>3 phase rectifying circuit</td>
<td>175,632 (5.7%)</td>
</tr>
<tr>
<td>Direct Current versus Alternating Current</td>
<td>170,852 (5.6%)</td>
</tr>
<tr>
<td>Wave Interference</td>
<td>166,597 (5.4%)</td>
</tr>
<tr>
<td>Full Wave Rectification with a Diode Bridge</td>
<td>155,258 (5.1%)</td>
</tr>
<tr>
<td>Creating a Longitudinal Wave</td>
<td>113,104 (3.7%)</td>
</tr>
<tr>
<td>Creating a Transverse Wave</td>
<td>96,626 (3.1%)</td>
</tr>
<tr>
<td>Creating Standing Waves</td>
<td>80,918 (2.6%)</td>
</tr>
<tr>
<td>The Right Hand Rule and the Magnetic Field with a Current Loop</td>
<td>75,882 (2.5%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Video views (last 365 days)</th>
<th>Views</th>
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</thead>
<tbody>
<tr>
<td>Longitudinal and Transverse Waves</td>
<td>33,377 (9.4%)</td>
</tr>
<tr>
<td>Creating a Longitudinal Wave</td>
<td>28,434 (8.0%)</td>
</tr>
<tr>
<td>Transverse and Longitudinal Waves</td>
<td>26,853 (7.5%)</td>
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<tr>
<td>Creating a Transverse Wave</td>
<td>21,493 (6.0%)</td>
</tr>
<tr>
<td>Lenz's Law</td>
<td>15,228 (4.3%)</td>
</tr>
<tr>
<td>Direct Current versus Alternating Current</td>
<td>14,004 (3.9%)</td>
</tr>
<tr>
<td>Creating Standing Waves</td>
<td>13,630 (3.8%)</td>
</tr>
<tr>
<td>x ray interactions</td>
<td>12,167 (3.4%)</td>
</tr>
<tr>
<td>Cavendish Experiment</td>
<td>10,283 (2.9%)</td>
</tr>
<tr>
<td>3 Phase Rectifying Circuit (HD)</td>
<td>8,923 (2.5%)</td>
</tr>
<tr>
<td>Wave Interference</td>
<td>8,202 (2.3%)</td>
</tr>
<tr>
<td>Full Wave Rectification with a Diode Bridge</td>
<td>7,711 (2.2%)</td>
</tr>
</tbody>
</table>
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• to Remix — to adapt the work

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Lenz’s Law
Circular Motion (excerpt)
Charge in a Magnetic Field (excerpt)

... also check out the magnetic confinement video
And Much More

- 272 animations on the Project Web Site
- 182 animations on the Project YouTube Channel