Bump Mapping

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Bump Mapping:
Surface Local Coordinate System
An Example of When the Surface Local Coordinate System Matters

An Example of When It Doesn't
Bump-mapping to Create Ripples

In 2D, a slope $m = \frac{dy}{dx}$. It can be expressed as the vector $[1, m]$.

The normal to the shape is the vector perpendicular to the vector slope:

$$ [1, m] \cdot [-m, 1] = 0, \text{ as it must be.} $$

So, if $z = -Amp \cdot \cos(2\pi x/Pd - 2\pi \text{Time})$, then the slope $dz/dx$ is:

$$ dz/dx = Amp \cdot 2\pi/Pd \cdot \sin(2\pi x/Pd - 2\pi \text{Time}), $$

and the vector slope is:

$$ \text{Slope} = [1, 0, Amp \cdot 2\pi/Pd \cdot \sin(2\pi x/Pd - 2\pi \text{Time})] $$
Following the pattern from before, the normal vector is:

\[
\text{[ Normal ]} = \begin{bmatrix} -\text{Amp} \cdot 2\pi/Pd \cdot \sin(2\pi x/Pd - 2\pi \text{Time}) , 0., 1. \end{bmatrix}
\]

This is true along just the X axis. The trick now is to rotate the normal vector into where we really are. Because we are just talking about a rotation, the transformation is the same as if we were rotating a vertex.

\[
\begin{align*}
\text{Nx'} &= \text{Nx} \cdot \cos \Theta - \text{Ny} \cdot \sin \Theta = \text{Nx} \cdot \cos \Theta \\
\text{Ny'} &= \text{Nx} \cdot \sin \Theta + \text{Ny} \cdot \cos \Theta = \text{Nx} \cdot \sin \Theta \\
\text{Nz'} &= \text{Nz} = 1.
\end{align*}
\]

(Note that in the final version, you will substitute R for x in the slope equation)

Embossing

Coming soon...
Terrain Height Bump-Mapping

Parallax Mapping

Coming soon...