Answer on Question #58076-Physics-Other

What are the applications/purposes of curl in physics?

Answer

Curl basically is a measure of how much a field of force can turn you or spin you about its axis or about your axis.

Obviously this ability depends upon how far you are from the center of the center of the force field (where usually the force field is the strongest.

Example 1: A hurricane Example 2: A whirlpool

When a whirlpool turns, the further you are from the center of the whirlpool, the lesser is the ability of the water involved to make you spin.

The curl of a vector function is the vector product of the $\vec{\nabla}$ operator with a vector function $\vec{E}$:

$$\begin{vmatrix} i & j & k \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ E_x & E_y & E_z \end{vmatrix}$$

These partial derivatives just trace the path of how much the influence of the curling force or spinning force reduce as you move along the x-axis or y-axis or z-axis away from the center (usually the source) of the curling whirlpool.

The value of Curl is maximum if you are perpendicular to the direction of the flow of field.

The i term or i plane indicates revolution about the horizontal plane. That means the object is experiencing a force which is making it revolve in the horizontal plane (much like a planet revolving around the sun or a satellite moving along the equator of the earth)

So, the j term or j plane indicates revolution about the vertical plane. That means the object is experiencing a force which is making it revolve slightly vertically also. Imagine a satellite moving along an inclined orbit around the earth.

The k term or k plane means now the object is rotating about its own axis also. So now our satellite is moving along an inclined path (i.e. slightly horizontally and slightly vertically simultaneously) and at the same time rotating about its own axis.