User Manual - Module vectors32

- Module name vectors32
- class name Vector
- Purpose - Vector algebra, including the scalar (dot) product and vector (cross) product

Instantiation

Let a, b, and c be 3 D vectors with components a.x, a.y, a.z, b.x etc. a and b are created by class instantiation as follows. First import the module and create local copy of the class Vector:

```
from vectors32 import vectors32
Vector = vectors32.Vector
```

Now a vector can be created by instantiating the Vector class as:

```
a = Vector(x, y, z)
```

where x,y and z are the respective components which can be accessed as a.x, a.y, a.z.

Examples

In the following we are providing examples. Preferably, the examples should be entered by hand in the Python Shell of the "Idle" IDE. They can also be entered into a Python Shell that opens up on the terminal after Python has been invoked. At this stage all examples are solved by Python 3.2.

Example

```
>>> v1 = Vector(2.0, 3.0, 4.0)
>>> v2 = Vector(6.6, 5.5, 4.5)
>>> print(v1)
Vector(2.0, 3.0, 4.0)
>>> print(v2)
Vector(6.6, 5.5, 4.5)
```

Notice that print command indicates that it is a "Vector" and shows all three components. A more detailed output could be produced by in output as follows:

```
print('v2 = ', v2)
v2 =  Vector(6.6, 5.5, 4.5)
```

A vector of zero components could be created as:

```
z = Vector()
```

A vector length ("size") is a property easily obtained in the following example.

Example

```
>>> v3 = Vector(5.0, 6.0 ,7.0)
>>> print(v3)
Vector(5.0, 6.0, 7.0)
>>> v3.size
10.488088481701515
```

Vector normalisation is also provided for. (Normalized vector has the same direction as the original vector, but is of a unit length.)

Example

```
>>> v4 = v3.normalize
>>> print(v3)
Vector(5.0, 6.0, 7.0)
>>> print(v4)
Vector(0.476731294623, 0.572077553547, 0.667423812472)
```

Vector addition and subtraction

```
c = a + b
c = a - b
```

Examples

::

```
>>> w1 = v1 + v2
>>> w2 = w1 - v2
>>> print(w1)
Vector(8.6, 8.5, 8.5)
>>> print(w2)
Vector(2.0, 3.0, 4.0)
```

Multiplication, all forms

Pre-multiply a vector with a scalar (either float or int), then post-multiply a vector with a scalar-

Examples

```
>>> w1 = 2 * v1
>>> print(v1)
Vector(2.0, 3.0, 4.0)
>>> w2 = v2 * 2
>>> print(w2)
Vector(13.2, 11.0, 9.0)
>>> w1 = v1 * 1.5
>>> print(w1)
Vector(3.0, 4.5, 6.0)
```

Scalar Product of two vectors.

Scalar (aka dot) product is the sum of the products of self.x * other.x, self.y * other.y, self.z * other.z. It a scalar. In engineering Structure Analysis Scalar products are useful in calculation of the direction cosines of members or of generalized forces.

Example

```
# Scalar (dot) product.
# The result is scalar.
>>> s = v1 * v2
>>> print(s)
47.7
>>> s = v2 * v1
>>> print(s)
47.7
```

Finally, a vector (aka dot) product is a vector at right angles to the two source vectors. A useful property is a x b == -(b x a). We indicate a vector product operator by "**".

Example

```
# Vector (cross) product.
>>> v1 = Vector(1, 2, 3.0)
>>> v2 = Vector(7., 6, 5)
>>> w1 = v1 ** v2
>>> print(w1)
Vector(-8.0, 16.0, -8.0)
>>> w2 = v2 ** v1
>>> print(w2)
Vector(8.0, -16.0, 8.0)
```

To be continued

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