Fotorealistyczna Grafika Komputerowa

Niech stanie się światłość

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Chapter 1

Hierarchical Index

1.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 2

Class Index

2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 3

Class Documentation

3.1 ray.Hit Class Reference

Documentation for a class Hit.

Public Member Functions

- def __init__ (self, point, distance, color, primitive)

  Constructor.

Public Attributes

- **point**
- **distance**
- **color**
- **primitive**

3.1.1 Detailed Description

Documentation for a class Hit.

The documentation for this class was generated from the following file:

- ray.py

3.2 light_intensity.LightIntensity Class Reference

Documentation for a class LightIntensity.

Public Member Functions

- def **__init__** (self, color=[0, 0, 0])
- def **__add__** (self, other)
- def **__truediv__** (self, other)

Static Public Member Functions

- def **clamp01** (value)
- def **clamp_0_255** (value)
- def **remap_0_255** (value)
- def **clamp_color** (color)

Public Attributes

- **color**

3.2.1 Detailed Description

Documentation for a class LightIntensity.

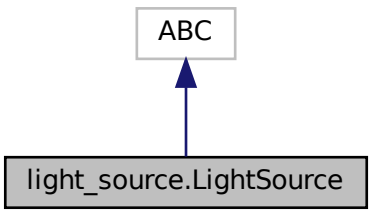
The documentation for this class was generated from the following file:

- light_intensity.py

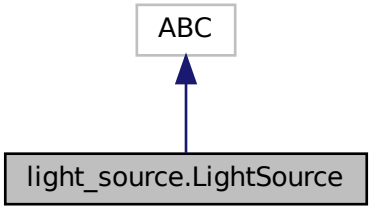
3.3 light_source.LightSource Class Reference

Documentation for a class LightSource.

Inheritance diagram for light_source.LightSource:



Collaboration diagram for light_source.LightSource:



Public Member Functions

- def __init__ (self, position=Vec3(0, 0, 0), color=[1, 1, 1], intensity=1)
  The constructor.
- def __str__ (self)
  Function returning object values in string format.

Public Attributes

- color
  Colour of light source.
- position
  Position of light source.
- intensity
  Intensity of light.

3.3.1 Detailed Description

Documentation for a class LightSource.

3.3.2 Constructor & Destructor Documentation

3.3.2.1 __init__()

```
def light_source.LightSource.__init__ (
              self,
              position = Vec3(0, 0, 0),
              color = [1, 1, 1],
              intensity = 1 )
```

The constructor.

Creates a LightSource with a specified Colour at a given Location.

The documentation for this class was generated from the following file:

- light_source.py

3.4 material.Material Class Reference

Documentation for a class Material.

Public Member Functions

- def __init__ (self, ambientColour=(1, 1, 1), diffuseColour=(1, 1, 1), reflectColour=(1, 1, 1), specularColour=(0, 0, 0), specularExponent=1, mirror_reflection_coefficient=1, diffuse_reflection_coefficient=1)

  The constructor.
- def __str__ (self)

  Function returning object values in string format.

Public Attributes

- ambientColour

  Colour of Material under white ambient light.
- diffuseColour

  Colour of Material under direct white light.
- reflectColour

  Colour of reflected rays under direct white light.
- specularColour

  Colour of Material's specular highlights.
- specularExponent

  'Hardness' of Material's specular hightlights - high values give small, sharp highlights.
- **mirror_reflection_coefficient**
- **diffuse_reflection_coefficient**

3.4.1 Detailed Description

Documentation for a class Material.

3.4.2 Member Data Documentation

3.4.2.1 ambientColour

`material.Material.ambientColour`

Colour of Material under white ambient light.

Usually, but not always, the same as diffuseColour.

3.4.2.2 diffuseColour

`material.Material.diffuseColour`

Colour of Material under direct white light.

Usually, but not always, the same as ambientColour.

3.4.2.3 reflectColour

`material.Material.reflectColour`

Colour of reflected rays under direct white light.

If this is zero then there are no reflections.

3.4.2.4 specularColour

`material.Material.specularColour`

Colour of Material's specular highlights.

If this is zero then there are no highlights.

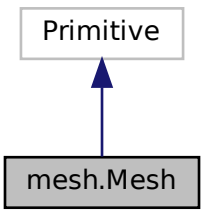
The documentation for this class was generated from the following file:

- material.py

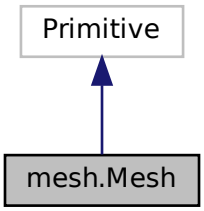
3.5 mesh.Mesh Class Reference

Documentation for a class Mesh.

Inheritance diagram for mesh.Mesh:



Collaboration diagram for mesh.Mesh:



Public Member Functions

- def __init__ (self, obj_file, position=Vec3(), material=None)

  Constructor.
- def get_detailed_intersections (self, ray)

  Checks if ray intersects with mesh and returns list of hits.
- def get_detailed_intersection (self, ray)

  Checks if ray intersects with mesh and returns hit closest to ray origin.
- def get_intersection (self, ray)

  Function returning intersection point.
- def **get_normal** (self, point)

Public Attributes

- **triangles**

3.5.1 Detailed Description

Documentation for a class Mesh.

The documentation for this class was generated from the following file:

- mesh.py

3.6 image.MyImage Class Reference

Documentation for a class MyImage.

Public Member Functions

- def __init__ (self, width=500, height=500)

  The constructor.
- def len (self)

  Function returning image length.
- def clear_color (self, rgb_color)

  Function setting background color.
- def fancy_background (self)

  Function setting background color.
- def set_pixel (self, i, j, value)

  Function changing pixel color.
- def get_pixel_color (self, i, j)

  Function getting pixel color.
- def save_image (self)

  Function saving image to png format.

Public Attributes

- **width**
- **height**
- **image_matrix**

3.6.1 Detailed Description

Documentation for a class MyImage.

The documentation for this class was generated from the following file:

- image.py

3.7 orthogonal_camera.OrthogonalCamera Class Reference

Class for othogonal camera.

Public Member Functions

- def __init__ (self, position=Vec3(0, 0, 0), view_direction=Vec3(0, 0, 1), width=512, height=512, pixel_↩ size=(0.01, 0.01))

  Constructor.
- def render_scene (self, primitives)

  Function rendering the scene.

Public Attributes

- position
  Position of the camera.
- view_direction
  Direction camera is facing.
- w
  Width in pixels.
- h
  Height in pixels.
- wh_ratio
  Width-height raio.
- hw_ratio
  Height-width ratio.
- arRay
  Array of rays.
- x_angle
  Angle between view direction vector and X axis.
- y_angle
  Angle between view direction vector and Y axis.
- z_angle
  Angle between view direction vector and Z axis.

3.7.1 Detailed Description

Class for othogonal camera.

The documentation for this class was generated from the following file:

- orthogonal_camera.py

3.8 perspective_camera.PerspectiveCamera Class Reference

Class for othogonal camera.

Public Member Functions

- def __init__ (self, position=Vec3(0, 0, 0), view_direction=Vec3(0, 0, 1), width=512, height=512, near=.1, far=1000, fov=60)
  Constructor.
- def render_scene (self, primitives, light_sources, antialiasing=True)
  Function rendering the scene.

Static Public Member Functions

- def adaptive_antialiasing (ray, A, B, C, D, E, depth, max_depth, horizontal, vertical, background_color, primitives, lights)
  Function calculating color of pixel using adaptive antialiasing.

Public Attributes

- position

  Position of the camera.
- view_direction

  Direction camera is facing.
- width

  Width in pixels.
- height

  Height in pixels.
- near

  Near clipping plane.
- far

  Far clipping plane.
- fov

  Field of View.
- up

  Vector direction aligned with the "up" direction of camera.

3.8.1 Detailed Description

Class for othogonal camera.

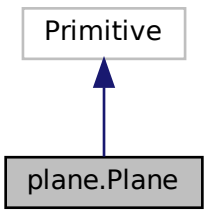
The documentation for this class was generated from the following file:

- perspective_camera.py

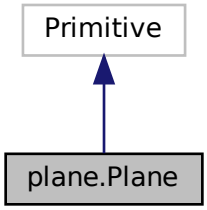
3.9 plane.Plane Class Reference

Documentation for a class Plane.

Inheritance diagram for plane.Plane:



Collaboration diagram for plane.Plane:



Public Member Functions

- def __init__ (self, normal_vector, d, color=[1, 0, 1], material=None)

  Constructor.
- def __str__ (self)

  Function returning object values in string format.
- def get_detailed_intersections (self, ray)

  Wrapper.
- def get_detailed_intersection (self, ray)

  Returns tuple with multiple data: point (None if no intersection), distance to point, color.
- def get_intersection (self, ray)

  Checks if plane and ray intersect witch each other and returns intersection point if they do, otherwise None.
- def **get_normal** (self, point)

Public Attributes

- normal_vector

  Vector perpendicular to plane.
- a

  Represents A in 'Ax + By + Cz D = 0' equation.
- b

  Represents B in 'Ax + By + Cz D = 0' equation.
- c

  Represents C in 'Ax + By + Cz D = 0' equation.
- d

  Represents D in 'Ax + By + Cz D = 0' equation.

3.9.1 Detailed Description

Documentation for a class Plane.

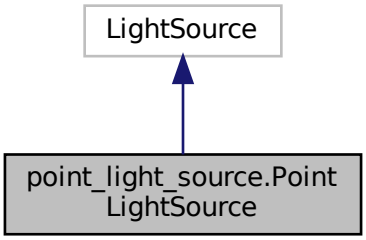
The documentation for this class was generated from the following file:

- plane.py

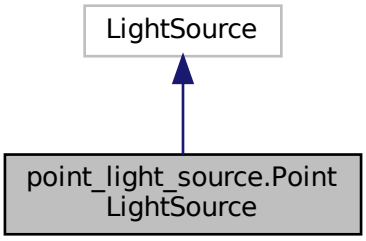
3.10 point_light_source.PointLightSource Class Reference

Documentation for a class PointLightSource.

Inheritance diagram for point_light_source.PointLightSource:



Collaboration diagram for point_light_source.PointLightSource:



Public Member Functions

- def **__init__** (self, position=[0, 0, 0], color=[1, 1, 1], intensity=1)

3.10.1 Detailed Description

Documentation for a class PointLightSource.

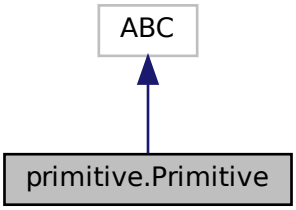
Light emitted from a Point.

The documentation for this class was generated from the following file:

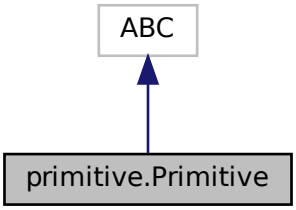
- point_light_source.py

3.11 primitive.Primitive Class Reference

Inheritance diagram for primitive.Primitive:



Collaboration diagram for primitive.Primitive:



Public Member Functions

- def **__init__** (self, color, material=None)
- def **get_intersection** (self, ray)
- def **get_detailed_intersection** (self, ray)
- def **get_detailed_intersections** (self, ray)
- def **get_normal** (self, point)

Public Attributes

- **color**
- **material**

The documentation for this class was generated from the following file:

- primitive.py

3.12 ray.Ray Class Reference

Documentation for a class Ray.

Public Member Functions

- def __init__ (self, origin=Vec3(0, 0, 0), direction=None, target=None, length=math.inf)

  Constructor.
- def __str__ (self)

  Function returning object values in string format.
- def is_point_on_ray (self, point)

  Check if point is on ray, returns true if yes, false otherwise.
- def set_direction (self, new_direction)

  Sets new direction vector and converts it to normalized vector.
- def set_target (self, new_target)

  Sets new target and updates direction vector.
- def get_plane_intersection (self, plane)

  Plane.get_intersection(ray) wrapper.
- def get_sphere_intersection (self, sphere)

  Sphere.get_intersection(ray) wrapper.
- def get_sphere_intersections (self, sphere)

  Sphere.get_ray_intersections(ray) wrapper.
- def get_pixel_hit (self, primitives)

  Iterates through list of primitives and returns hit.
- def **get_pixel_color** (self, primitives, lights)
- def **check_intersection** (self, primitives)

Public Attributes

- origin

  Origin vector of a given ray.
- direction

  Direction vector of a given ray.
- target

  Target point of a given ray.
- length

  Length of a given ray.

3.12.1 Detailed Description

Documentation for a class Ray.

3.12.2 Member Data Documentation

3.12.2.1 direction

`ray.Ray.direction`

Direction vector of a given ray.

Cannot be (0, 0, 0).

3.12.2.2 length

`ray.Ray.length`

Length of a given ray.

Default = Infinity

3.12.2.3 origin

`ray.Ray.origin`

Origin vector of a given ray.

Default = (0, 0, 0)

3.12.2.4 target

`ray.Ray.target`

Target point of a given ray.

Cannot be the same as origin.

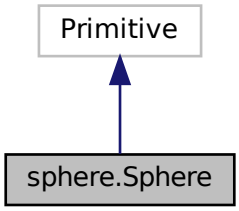
The documentation for this class was generated from the following file:

- ray.py

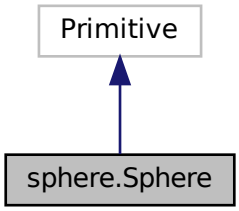
3.13 sphere.Sphere Class Reference

Documentation for a class Sphere.

Inheritance diagram for sphere.Sphere:



Collaboration diagram for sphere.Sphere:



Public Member Functions

- def __init__ (self, centre=Vec3(0, 0, 0), radius=1, color=[1, 0, 1], material=None)

  Constructor.
- def change_radius (self, new_radius)

  Sets radius and recalculates area and volume.
- def __str__ (self)

  Function returning object values in string format.
- def get_detailed_intersections (self, ray)

  Checks if ray intersects with sphere and returns list of hits.
- def get_detailed_intersection (self, ray)

  Function returning hit.
- def get_intersection (self, ray)

  Checks if ray intersects with sphere and returns point closest to ray origin.
- def get_normal (self, point)

  Gets normal for given point.

Public Attributes

- centre

  Centre of the sphere.
- **color**
- radius

  Radius of the sphere.
- area

  Area of the sphere.
- volume

  Volume of the sphere.

3.13.1 Detailed Description

Documentation for a class Sphere.

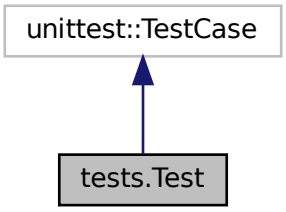
The documentation for this class was generated from the following file:

- sphere.py

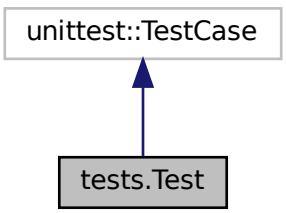
3.14 tests.Test Class Reference

Documentation for a class Test.

Inheritance diagram for tests.Test:



Collaboration diagram for tests.Test:



Public Member Functions

- def **setUp** (self)
- def test_add (self)

  Vector tests.
- def test_sub (self)

  Vector tests.
- def test_pos (self)

  Vector tests.
- def test_neg (self)

  Vector tests.
- def test_length (self)

  Vector tests.
- def test___truediv__ (self)

  Vector tests.
- def test_mul (self)

  Vector tests.
- def test_cross (self)

  Vector tests.
- def test_point_on_line (self)

  Ray tests.
- def test_plane_intersection (self)

  Plane tests.
- def test_get_centre (self)

  Sphere tests.
- def test_get_radius (self)

  Sphere tests.
- def test_surface_area (self)

  Sphere tests.
- def test_get_volume (self)

  Sphere tests.
- def test_get_sphere_intersection (self)

  Sphere tests.
- def test_clamp_0_255 (self)

  Light intensity tests.

Public Attributes

- **v1**
- **v2**
- **v3**
- **v4**
- **v5**
- **v6**
- **v7**
- **r1**
- **r2**
- **r3**
- **r4**
- **p1**
- **p2**
- **s1**
- **s2**
- **li1**
- **li2**
- **li3**

3.14.1 Detailed Description

Documentation for a class Test.

Unit tests.

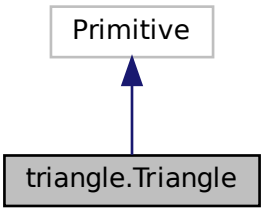
The documentation for this class was generated from the following file:

- tests.py

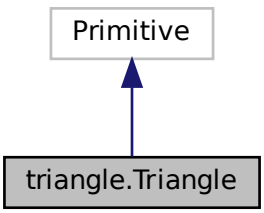
3.15 triangle.Triangle Class Reference

Documentation for a class Triangle.

Inheritance diagram for triangle.Triangle:



Collaboration diagram for triangle.Triangle:



Public Member Functions

- def __init__ (self, v1=Vec3(0, 0, 0), v2=Vec3(0, 0, 0), v3=Vec3(0, 0, 0), color=[1, 0, 1], material=None)

  Constructor.
- def __str__ (self)

  Function returning object values in string format.
- def get_detailed_intersections (self, ray)

  Checks if ray intersects with triangle and returns hit in form of a list.
- def get_detailed_intersection (self, ray)

  Checks if ray intercescts with triangle and returns hit.
- def get_intersection (self, ray)

  Checks if ray intersects with triangle and return intersection point.
- def **get_normal** (self, point)

Public Attributes

- v1

  Triangle vertex.
- v2

  Triangle vertex.
- v3

  Triangle vertex.
- color

  Color of triangle.
- normal_vector

  Vector perpendicular to plane.

3.15.1 Detailed Description

Documentation for a class Triangle.

The documentation for this class was generated from the following file:

- triangle.py

3.16 vector.Vec2 Class Reference

Documentation for a class Vec2.

Public Member Functions

- def __init__ (self, x, y)

  The constructor.
- def __add__ (self, other)

  Function returning sum of two vectors or sum of a vector and a scalar.
- def __iadd__ (self, other)

  Function returning sum (In-place addition) of two vectors or sum of a vector and a scalar.
- def __sub__ (self, other)

  Function returning difference of two vectors or difference of a vector and a scalar.
- def __isub__ (self, other)

  Function returning difference (In-place Subtraction) of two vectors or difference of a vector and a scalar.
- def __eq__ (self, other)

  Function "equal".
- def __abs__ (self)

  Function returning absolute value of a given vector.
- def __ne__ (self, other)

  Function "not equal".
- def __neg__ (self)

  Function negating vector coordinates.
- def __pos__ (self)

  Function for positive vector coordinates.
- def __str__ (self)

  Function returning object values in string format.
- def length (self)

  Function returning vector length.
- def distance (self, other)

  Function returning the length of the displacement vector (distance between two points).
- def __truediv__ (self, other)

  Function returning quotient of two vectors or quotient of a vector and a scalar.
- def __itruediv__ (self, other)

  Function returning quotient (In-place Division) of two vectors or quotient of a vector and a scalar.
- def __mul__ (self, other)

  Function returning dot product of two vectors or dot product of a vector and a scalar.
- def __imul__ (self, other)

  Function returning dot product (In-place multiplication) of two vectors or dot product of a vector and a scalar.
- def __rmul__ (self, other)

  Function returning cross product of two vectors.

Public Attributes

- x

  A class variable.
- y

  A class variable.

3.16.1 Detailed Description

Documentation for a class Vec2.

3.16.2 Member Data Documentation

3.16.2.1 x

`vector.Vec2.x`

A class variable.

Coordinate x of a given vector.

3.16.2.2 y

`vector.Vec2.y`

A class variable.

Coordinate y of a given vector.

The documentation for this class was generated from the following file:

- vector.py

3.17 vector.Vec3 Class Reference

Documentation for a class Vec3.

Public Member Functions

- def __init__ (self, x=0, y=0, z=0)

  The constructor.
- def **x** (self)
- def **x** (self, inp)
- def **x** (self)
- def **y** (self)
- def **y** (self, inp)
- def **y** (self)
- def **z** (self)
- def **z** (self, inp)
- def **z** (self)
- def __add__ (self, other)

  Function returning sum of two vectors or sum of a vector and a scalar.
- def __iadd__ (self, other)

  Function returning sum (In-place addition) of two vectors or sum of a vector and a scalar.
- def __sub__ (self, other)

  Function returning difference of two vectors or difference of a vector and a scalar.
- def __isub__ (self, other)

Function returning difference (In-place Subtraction) of two vectors or difference of a vector and a scalar.

- def __eq__ (self, other)

  Function "equal".
- def __abs__ (self)

  Function returning absolute value of a given vector.
- def __ne__ (self, other)

  Function "not equal".
- def __neg__ (self)

  Function negating vector coordinates.
- def __pos__ (self)

  Function for positive vector coordinates.
- def __str__ (self)

  Function returning object values in string format.
- def length (self)

  Function returning vector length.
- def distance (self, other)

  Function returning the length of the displacement vector (distance between two points).
- def is_point_on_ray (self, ray)

  Is point on ray wrapper.
- def **normalized** (self)
- def __truediv__ (self, other)

  Function returning quotient of two vectors or quotient of a vector and a scalar.
- def __itruediv__ (self, other)

  Function returning quotient (In-place Division) of two vectors or quotient of a vector and a scalar.
- def __mul__ (self, other)

  Function returning dot product of two vectors or dot product of a vector and a scalar.
- def __imul__ (self, other)

  Function returning dot product (In-place multiplication) of two vectors or dot product of a vector and a scalar.
- def __rmul__ (self, other)

  Function returning dot product (Reverse multiplication).
- def cross (self, other)

  Function returning cross product of two vectors.

Public Attributes

- x

  A class variable.
- y

  A class variable.
- z

  A class variable.

Static Public Attributes

- def r = x

  Alias
- def g = y

  Alias.
- def b = z

  Alias.

3.17.1 Detailed Description

Documentation for a class Vec3.

3.17.2 Member Data Documentation

3.17.2.1 x

`vector.Vec3.x`

A class variable.

Coordinate x of a given vector.

3.17.2.2 y

`vector.Vec3.y`

A class variable.

Coordinate y of a given vector.

3.17.2.3 z

`vector.Vec3.z`

A class variable.

Coordinate z of a given vector.

The documentation for this class was generated from the following file:

- vector.py

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