

EarthLightingModel

5.0

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Chapter 1

Module Index

1.1 Modules

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Chapter 2

Namespace Index

2.1 Namespace List

Here is a list of all namespaces with brief descriptions:

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Chapter 3

Data Structure Index

3.1 Data Structures

Here are the data structures with brief descriptions:

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Chapter 4

File Index

4.1 File List

Here is a list of all files with brief descriptions:

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Chapter 5

Module Documentation

5.1 Models

Modules

- [Environment](#)

5.1.1 Detailed Description

5.2 Environment

Modules

- [EarthLighting](#)

5.2.1 Detailed Description

5.3 EarthLighting

Files

- file [class_declarations.hh](#)
Forward declarations of classes defined for JEOD 2.0 Earth Lighting.
- file [earth_lighting.hh](#)
Calculates lighting information from the Earth, Sun and Moon for a vehicle in low Earth orbit.
- file [earth_lighting_messages.hh](#)
Implement earth_lighting_messages.
- file [earth_lighting.cc](#)
Implementation of the classes necessary for calculating Sun, Moon and Earth lighting effects on a vehicle orbiting the Earth.
- file [earth_lighting_messages.cc](#)
Implement earth_lighting_messages.

Namespaces

- [jeod](#)
Namespace jeod.

Macros

- `#define EPSILON 1.0e-12`
- `#define PATH "environment/earth_lighting/"`

5.3.1 Detailed Description

5.3.2 Macro Definition Documentation

5.3.2.1 EPSILON

```
#define EPSILON 1.0e-12
```

Definition at line 53 of file `earth_lighting.cc`.

Referenced by `jeod::EarthLighting::circle_intersect()`.

5.3.2.2 PATH

```
#define PATH "environment/earth_lighting/"
```

Definition at line 36 of file `earth_lighting_messages.cc`.

Chapter 6

Namespace Documentation

6.1 jeod Namespace Reference

Namespace jeod.

Data Structures

- class [EarthLighting](#)
A class for calculating lighting effects in low Earth orbit.
- class [EarthLightingMessages](#)
Describes messages used in the earth lighting model.
- class [LightingBody](#)
Represents a major source of light in a space environment, such as the sun, the Earth, the moon, etc.
- class [LightingParams](#)
Contains important parameters for lighting information.

6.1.1 Detailed Description

Namespace jeod.

Chapter 7

Data Structure Documentation

7.1 jeod::EarthLighting Class Reference

A class for calculating lighting effects in low Earth orbit.

```
#include <earth_lighting.hh>
```

Public Member Functions

- [EarthLighting](#) ()
Default constructor.
- [~EarthLighting](#) ()
Destructor.
- void [initialize](#) (DynManager &manager)
Initializes the [EarthLighting](#) object form the DynManager object.
- int [circle_intersect](#) (double r_bottom, double r_top, double d_centers, double *area)
- void [calc_lighting](#) (double pos_veh[3])
Calculate earth lighting effects at the given position.

Data Fields

- bool [active](#)
flag for if the model is active or not
- Planet * [earth](#)
Pointer to the Earth planet from the DynManager.
- Planet * [moon](#)
Pointer to the Moon planet from the DynManager.
- Planet * [sun](#)
Pointer to the Sun planet from the DynManager.
- const RefFrame * [earth_frame](#)
Pointer to the translation information for Earth inertial.
- const RefFrame * [moon_frame](#)
Pointer to the translation information for Moon inertial.
- const RefFrame * [sun_frame](#)

Pointer to the translation information for Sun inertial.

- [LightingBody sun_body](#)

Sun stellar parameters.

- [LightingBody earth_body](#)

Earth planetary parameters.

- [LightingBody moon_body](#)

Lunar planetary parameters.

- [LightingParams sun_earth](#)

Lighting of sun w.r.t.

- [LightingParams moon_earth](#)

Lighting of moon w.r.t.

- [LightingParams earth_albedo](#)

Earth albedo lighting.

Protected Attributes

- double [pos_moon](#) [3]

Moon position wrt Earth inertial.

- double [pos_sun](#) [3]

Sun position wrt Earth inertial.

Private Member Functions

- [EarthLighting](#) & [operator=](#) (const [EarthLighting](#) &rhs)
- [EarthLighting](#) (const [EarthLighting](#) &rhs)

Friends

- class [InputProcessor](#)
- void [init_attrjeod__EarthLighting](#) ()

7.1.1 Detailed Description

A class for calculating lighting effects in low Earth orbit.

Definition at line 176 of file `earth_lighting.hh`.

7.1.2 Constructor & Destructor Documentation

7.1.2.1 EarthLighting() [1/2]

```
jeod::EarthLighting::EarthLighting (
    void )
```

Default constructor.

Definition at line 148 of file earth_lighting.cc.

References pos_moon, and pos_sun.

7.1.2.2 ~EarthLighting()

```
jeod::EarthLighting::~~EarthLighting (
    void )
```

Destructor.

Definition at line 172 of file earth_lighting.cc.

7.1.2.3 EarthLighting() [2/2]

```
jeod::EarthLighting::EarthLighting (
    const EarthLighting & rhs ) [private]
```

7.1.3 Member Function Documentation

7.1.3.1 calc_lighting()

```
void jeod::EarthLighting::calc_lighting (
    double pos_veh[3] )
```

Calculate earth lighting effects at the given position.

Parameters

in	<i>pos_veh</i>	The position of the point of interest in the earth inertial frame Units: M
----	----------------	---

Definition at line 375 of file earth_lighting.cc.

References active, circle_intersect(), jeod::LightingBody::distance, earth_albedo, earth_body, earth_frame, jeod::LightingBody::half_angle, jeod::LightingParams::lighting, moon_body, moon_earth, moon_frame, jeod::Lighting

Params::obs_angle, jeod::LightingParams::occlusion, jeod::LightingParams::phase, pos_moon, pos_sun, jeod::LightingBody::position, jeod::LightingBody::radius, sun_body, sun_earth, sun_frame, and jeod::LightingParams::visible.

7.1.3.2 circle_intersect()

```
int jeod::EarthLighting::circle_intersect (
    double r_bottom,
    double r_top,
    double d_centers,
    double * area )
```

Definition at line 278 of file earth_lighting.cc.

References EPSILON.

Referenced by calc_lighting().

7.1.3.3 initialize()

```
void jeod::EarthLighting::initialize (
    DynManager & manager )
```

Initializes the [EarthLighting](#) object form the DynManager object.

Will find the Earth, Sun and Moon objects and do the necessary setup to calculate earth lighting

Parameters

in	<i>manager</i>	The Dyn Manager object that includes the ephemeris for Sun, Earth and Moon
----	----------------	--

Definition at line 198 of file earth_lighting.cc.

References earth, earth_body, earth_frame, jeod::EarthLightingMessages::initialization_error, moon, moon_body, moon_frame, jeod::LightingBody::radius, sun, sun_body, and sun_frame.

7.1.3.4 operator=()

```
EarthLighting& jeod::EarthLighting::operator= (
    const EarthLighting & rhs ) [private]
```

7.1.4 Friends And Related Function Documentation

7.1.4.1 init_attrjeod__EarthLighting

```
void init_attrjeod__EarthLighting ( ) [friend]
```

7.1.4.2 InputProcessor

```
friend class InputProcessor [friend]
```

Definition at line 178 of file earth_lighting.hh.

7.1.5 Field Documentation

7.1.5.1 active

```
bool jeod::EarthLighting::active
```

flag for if the model is active or not

trick_units(-)

Definition at line 200 of file earth_lighting.hh.

Referenced by calc_lighting().

7.1.5.2 earth

```
Planet* jeod::EarthLighting::earth
```

Pointer to the Earth planet from the DynManager.

trick_units(-)

Definition at line 205 of file earth_lighting.hh.

Referenced by initialize().

7.1.5.3 earth_albedo

`LightingParams jeod::EarthLighting::earth_albedo`

Earth albedo lighting.

`trick_units(-)`

Definition at line 252 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`.

7.1.5.4 earth_body

`LightingBody jeod::EarthLighting::earth_body`

Earth planetary parameters.

`trick_units(-)`

Definition at line 235 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`, and `initialize()`.

7.1.5.5 earth_frame

`const RefFrame* jeod::EarthLighting::earth_frame`

Pointer to the translation information for Earth inertial.

`trick_units(-)`

Definition at line 218 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`, and `initialize()`.

7.1.5.6 moon

`Planet* jeod::EarthLighting::moon`

Pointer to the Moon planet from the DynManager.

`trick_units(-)`

Definition at line 209 of file `earth_lighting.hh`.

Referenced by `initialize()`.

7.1.5.7 moon_body

`LightingBody` jeod::EarthLighting::moon_body

Lunar planetary parameters.

`trick_units(-)`

Definition at line 239 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`, and `initialize()`.

7.1.5.8 moon_earth

`LightingParams` jeod::EarthLighting::moon_earth

Lighting of moon w.r.t.

`vehicle.trick_units(-)`

Definition at line 248 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`.

7.1.5.9 moon_frame

`const RefFrame*` jeod::EarthLighting::moon_frame

Pointer to the translation information for Moon inertial.

`trick_units(-)`

Definition at line 222 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`, and `initialize()`.

7.1.5.10 pos_moon

`double` jeod::EarthLighting::pos_moon[3] [protected]

Moon position wrt Earth inertial.

`trick_units(m)`

Definition at line 262 of file `earth_lighting.hh`.

Referenced by `calc_lighting()`, and `EarthLighting()`.

7.1.5.11 pos_sun

```
double jeod::EarthLighting::pos_sun[3] [protected]
```

Sun position wrt Earth inertial.

trick_units(m)

Definition at line 266 of file earth_lighting.hh.

Referenced by calc_lighting(), and EarthLighting().

7.1.5.12 sun

```
Planet* jeod::EarthLighting::sun
```

Pointer to the Sun planet from the DynManager.

trick_units(-)

Definition at line 213 of file earth_lighting.hh.

Referenced by initialize().

7.1.5.13 sun_body

```
LightingBody jeod::EarthLighting::sun_body
```

Sun stellar parameters.

trick_units(-)

Definition at line 231 of file earth_lighting.hh.

Referenced by calc_lighting(), and initialize().

7.1.5.14 sun_earth

```
LightingParams jeod::EarthLighting::sun_earth
```

Lighting of sun w.r.t.

vehicle.trick_units(-)

Definition at line 244 of file earth_lighting.hh.

Referenced by calc_lighting().

7.1.5.15 sun_frame

```
const RefFrame* jeod::EarthLighting::sun_frame
```

Pointer to the translation information for Sun inertial.

trick_units(-)

Definition at line 226 of file earth_lighting.hh.

Referenced by calc_lighting(), and initialize().

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

- [earth_lighting.hh](#)
- [earth_lighting.cc](#)

7.2 jeod::EarthLightingMessages Class Reference

Describes messages used in the earth lighting model.

```
#include <earth_lighting_messages.hh>
```

Static Public Attributes

- static char const * [initialization_error](#)
Indicates an error during initialization.

Private Member Functions

- [EarthLightingMessages](#) (void)
- [EarthLightingMessages](#) (const [EarthLightingMessages](#) &rhs)
- [EarthLightingMessages](#) & [operator=](#) (const [EarthLightingMessages](#) &rhs)

Friends

- class [InputProcessor](#)
- void [init_attrjeod__EarthLightingMessages](#) ()

7.2.1 Detailed Description

Describes messages used in the earth lighting model.

Definition at line 82 of file earth_lighting_messages.hh.

7.2.2 Constructor & Destructor Documentation

7.2.2.1 EarthLightingMessages() [1/2]

```
jeod::EarthLightingMessages::EarthLightingMessages (
    void ) [private]
```

7.2.2.2 EarthLightingMessages() [2/2]

```
jeod::EarthLightingMessages::EarthLightingMessages (
    const EarthLightingMessages & rhs ) [private]
```

7.2.3 Member Function Documentation

7.2.3.1 operator=()

```
EarthLightingMessages& jeod::EarthLightingMessages::operator= (
    const EarthLightingMessages & rhs ) [private]
```

7.2.4 Friends And Related Function Documentation

7.2.4.1 init_attrjeod__EarthLightingMessages

```
void init_attrjeod__EarthLightingMessages ( ) [friend]
```

7.2.4.2 InputProcessor

```
friend class InputProcessor [friend]
```

Definition at line 84 of file earth_lighting_messages.hh.

7.2.5 Field Documentation

7.2.5.1 initialization_error

```
char const * jeod::EarthLightingMessages::initialization_error [static]
```

Initial value:

```
=
    "environment/earth_lighting/" "initialization_error"
```

Indicates an error during initialization.

trick_units(−)

Definition at line 95 of file earth_lighting_messages.hh.

Referenced by jeod::EarthLighting::initialize().

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

- [earth_lighting_messages.hh](#)
- [earth_lighting_messages.cc](#)

7.3 jeod::LightingBody Class Reference

Represents a major source of light in a space environment, such as the sun, the Earth, the moon, etc.

```
#include <earth_lighting.hh>
```

Public Member Functions

- [LightingBody](#) ()
Default constructor.
- [~LightingBody](#) ()
Destructor.

Data Fields

- double [radius](#)
Celestial body mean equitorial radius.
- double [position](#) [3]
Inertial position relative to observer.
- double [distance](#)
Distance from observer to light body.
- double [half_angle](#)
Apparent half angle of body disk.

Private Member Functions

- `LightingBody` & `operator=` (const `LightingBody` &rhs)
- `LightingBody` (const `LightingBody` &rhs)

Friends

- class `InputProcessor`
- void `init_attrjeod__LightingBody` ()

7.3.1 Detailed Description

Represents a major source of light in a space environment, such as the sun, the Earth, the moon, etc.

Definition at line 85 of file `earth_lighting.hh`.

7.3.2 Constructor & Destructor Documentation

7.3.2.1 `LightingBody()` [1/2]

```
jeod::LightingBody::LightingBody (
    void )
```

Default constructor.

Definition at line 68 of file `earth_lighting.cc`.

References `position`.

7.3.2.2 `~LightingBody()`

```
jeod::LightingBody::~~LightingBody (
    void )
```

Destructor.

Definition at line 87 of file `earth_lighting.cc`.

7.3.2.3 `LightingBody()` [2/2]

```
jeod::LightingBody::LightingBody (
    const LightingBody & rhs ) [private]
```


7.3.3 Member Function Documentation

7.3.3.1 operator=()

```
LightingBody& jeod::LightingBody::operator= (
    const LightingBody & rhs ) [private]
```

7.3.4 Friends And Related Function Documentation

7.3.4.1 init_attrjeod__LightingBody

```
void init_attrjeod__LightingBody ( ) [friend]
```

7.3.4.2 InputProcessor

```
friend class InputProcessor [friend]
```

Definition at line 87 of file earth_lighting.hh.

7.3.5 Field Documentation

7.3.5.1 distance

```
double jeod::LightingBody::distance
```

Distance from observer to light body.

```
trick_units(m)
```

Definition at line 108 of file earth_lighting.hh.

Referenced by jeod::EarthLighting::calc_lighting().

7.3.5.2 half_angle

```
double jeod::LightingBody::half_angle
```

Apparent half angle of body disk.

trick_units(rad)

Definition at line 112 of file earth_lighting.hh.

Referenced by jeod::EarthLighting::calc_lighting().

7.3.5.3 position

```
double jeod::LightingBody::position[3]
```

Inertial position relative to observer.

trick_units(m)

Definition at line 104 of file earth_lighting.hh.

Referenced by jeod::EarthLighting::calc_lighting(), and LightingBody().

7.3.5.4 radius

```
double jeod::LightingBody::radius
```

Celestial body mean equitorial radius.

trick_units(m)

Definition at line 100 of file earth_lighting.hh.

Referenced by jeod::EarthLighting::calc_lighting(), and jeod::EarthLighting::initialize().

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

- [earth_lighting.hh](#)
- [earth_lighting.cc](#)

7.4 jeod::LightingParams Class Reference

Contains important parameters for lighting information.

```
#include <earth_lighting.hh>
```

Public Member Functions

- [LightingParams](#) ()
Default constructor.
- [~LightingParams](#) ()
Destructor.

Data Fields

- double [obs_angle](#)
Apparent observation angle from light source.
- double [phase](#)
Apparent lighting phase of planet.
- double [occlusion](#)
Fraction of planetary surface occlusion.
- double [visible](#)
Fraction of planetary surface visible.
- double [lighting](#)
*Fraction of lighting ($phase * visible$).*

Private Member Functions

- [LightingParams](#) & [operator=](#) (const [LightingParams](#) &rhs)
- [LightingParams](#) (const [LightingParams](#) &rhs)

Friends

- class [InputProcessor](#)
- void [init_attrjeod__LightingParams](#) ()

7.4.1 Detailed Description

Contains important parameters for lighting information.

Definition at line 128 of file earth_lighting.hh.

7.4.2 Constructor & Destructor Documentation

7.4.2.1 LightingParams() [1/2]

```
jeod::LightingParams::LightingParams (
    void )
```

Default constructor.

Definition at line 106 of file earth_lighting.cc.

7.4.2.2 ~LightingParams()

```
jeod::LightingParams::~~LightingParams (
    void )
```

Destructor.

Definition at line 129 of file earth_lighting.cc.

7.4.2.3 LightingParams() [2/2]

```
jeod::LightingParams::LightingParams (
    const LightingParams & rhs ) [private]
```

7.4.3 Member Function Documentation

7.4.3.1 operator=()

```
LightingParams& jeod::LightingParams::operator= (
    const LightingParams & rhs ) [private]
```

7.4.4 Friends And Related Function Documentation

7.4.4.1 init_attrjeod__LightingParams

```
void init_attrjeod__LightingParams ( ) [friend]
```

7.4.4.2 InputProcessor

```
friend class InputProcessor [friend]
```

Definition at line 130 of file earth_lighting.hh.

7.4.5 Field Documentation

7.4.5.1 lighting

`double jeod::LightingParams::lighting`

Fraction of lighting (phase * visible).

`trick_units(-)`

Definition at line 161 of file `earth_lighting.hh`.

Referenced by `jeod::EarthLighting::calc_lighting()`.

7.4.5.2 obs_angle

`double jeod::LightingParams::obs_angle`

Apparent observation angle from light source.

`trick_units(rad)`

Definition at line 143 of file `earth_lighting.hh`.

Referenced by `jeod::EarthLighting::calc_lighting()`.

7.4.5.3 occlusion

`double jeod::LightingParams::occlusion`

Fraction of planetary surface occlusion.

`trick_units(-)`

Definition at line 153 of file `earth_lighting.hh`.

Referenced by `jeod::EarthLighting::calc_lighting()`.

7.4.5.4 phase

`double jeod::LightingParams::phase`

Apparent lighting phase of planet.

`trick_units(-)`

Definition at line 148 of file `earth_lighting.hh`.

Referenced by `jeod::EarthLighting::calc_lighting()`.

7.4.5.5 visible

`double jeod::LightingParams::visible`

Fraction of planetary surface visible.

`trick_units(-)`

Definition at line 157 of file `earth_lighting.hh`.

Referenced by `jeod::EarthLighting::calc_lighting()`.

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

- [earth_lighting.hh](#)
- [earth_lighting.cc](#)

Chapter 8

File Documentation

8.1 `class_declarations.hh` File Reference

Forward declarations of classes defined for JEOD 2.0 Earth Lighting.

Namespaces

- [jeod](#)

Namespace jeod.

8.1.1 Detailed Description

Forward declarations of classes defined for JEOD 2.0 Earth Lighting.

8.2 `earth_lighting.cc` File Reference

Implementation of the classes necessary for calculating Sun, Moon and Earth lighting effects on a vehicle orbiting the Earth.

```
#include <cmath>
#include <cstdlib>
#include "dynamics/dyn_manager/include/dyn_manager.hh"
#include "environment/planet/include/planet.hh"
#include "utils/message/include/message_handler.hh"
#include "utils/math/include/vector3.hh"
#include "../include/earth_lighting.hh"
#include "../include/earth_lighting_messages.hh"
```

Namespaces

- [jeod](#)

Namespace jeod.

Macros

- `#define EPSILON 1.0e-12`

8.2.1 Detailed Description

Implementation of the classes necessary for calculating Sun, Moon and Earth lighting effects on a vehicle orbiting the Earth.

8.3 earth_lighting.hh File Reference

Calculates lighting information from the Earth, Sun and Moon for a vehicle in low Earth orbit.

```
#include "dynamics/dyn_manager/include/class_declarations.hh"
#include "environment/planet/include/class_declarations.hh"
#include "utils/ref_frames/include/class_declarations.hh"
#include "utils/sim_interface/include/jeod_class.hh"
#include "environment/planet/include/planet.hh"
#include "utils/ref_frames/include/ref_frame.hh"
```

Data Structures

- class `jeod::LightingBody`
Represents a major source of light in a space environment, such as the sun, the Earth, the moon, etc.
- class `jeod::LightingParams`
Contains important parameters for lighting information.
- class `jeod::EarthLighting`
A class for calculating lighting effects in low Earth orbit.

Namespaces

- `jeod`
Namespace jeod.

8.3.1 Detailed Description

Calculates lighting information from the Earth, Sun and Moon for a vehicle in low Earth orbit.

8.4 earth_lighting_messages.cc File Reference

Implement `earth_lighting_messages`.

```
#include "../include/earth_lighting_messages.hh"
```


Namespaces

- [jeod](#)
Namespace jeod.

Macros

- `#define PATH "environment/earth_lighting/"`

8.4.1 Detailed Description

Implement earth_lighting_messages.

8.5 earth_lighting_messages.hh File Reference

Implement earth_lighting_messages.

```
#include "utils/sim_interface/include/jeod_class.hh"
```

Data Structures

- class [jeod::EarthLightingMessages](#)
Describes messages used in the earth lighting model.

Namespaces

- [jeod](#)
Namespace jeod.

8.5.1 Detailed Description

Implement earth_lighting_messages.

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