

ThermalModel

5.0

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# Contents

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>Module Index</b>                               | <b>1</b>  |
| 1.1      | Modules . . . . .                                 | 1         |
| <b>2</b> | <b>Namespace Index</b>                            | <b>3</b>  |
| 2.1      | Namespace List . . . . .                          | 3         |
| <b>3</b> | <b>Hierarchical Index</b>                         | <b>5</b>  |
| 3.1      | Class Hierarchy . . . . .                         | 5         |
| <b>4</b> | <b>Data Structure Index</b>                       | <b>7</b>  |
| 4.1      | Data Structures . . . . .                         | 7         |
| <b>5</b> | <b>File Index</b>                                 | <b>9</b>  |
| 5.1      | File List . . . . .                               | 9         |
| <b>6</b> | <b>Module Documentation</b>                       | <b>11</b> |
| 6.1      | Models . . . . .                                  | 11        |
| 6.1.1    | Detailed Description . . . . .                    | 11        |
| 6.2      | Interactions . . . . .                            | 12        |
| 6.2.1    | Detailed Description . . . . .                    | 12        |
| 6.3      | ThermalRider . . . . .                            | 13        |
| 6.3.1    | Detailed Description . . . . .                    | 13        |
| 6.3.2    | Macro Definition Documentation . . . . .          | 13        |
| 6.3.2.1  | PATH . . . . .                                    | 13        |
| <b>7</b> | <b>Namespace Documentation</b>                    | <b>15</b> |
| 7.1      | jeod Namespace Reference . . . . .                | 15        |
| 7.1.1    | Detailed Description . . . . .                    | 15        |
| <b>8</b> | <b>Data Structure Documentation</b>               | <b>17</b> |
| 8.1      | jeod::ThermalFacetRider Class Reference . . . . . | 17        |
| 8.1.1    | Detailed Description . . . . .                    | 18        |
| 8.1.2    | Constructor & Destructor Documentation . . . . .  | 18        |
| 8.1.2.1  | ThermalFacetRider . . . . .                       | 18        |

|          |   |    |
|----------|---|----|
| 8.1.2.2  | <a href="#">~ThermalFacetRider</a>                            | 19 |
| 8.1.2.3  | <a href="#">ThermalFacetRider</a>                             | 19 |
| 8.1.3    | <a href="#">Member Function Documentation</a>                 | 19 |
| 8.1.3.1  | <a href="#">accumulate_thermal_sources</a>                    | 19 |
| 8.1.3.2  | <a href="#">initialize</a>                                    | 19 |
| 8.1.3.3  | <a href="#">integrate</a>                                     | 19 |
| 8.1.3.4  | <a href="#">operator=</a>                                     | 19 |
| 8.1.4    | <a href="#">Friends And Related Function Documentation</a>    | 19 |
| 8.1.4.1  | <a href="#">init_attrjeod__ThermalFacetRider</a>              | 19 |
| 8.1.4.2  | <a href="#">InputProcessor</a>                                | 19 |
| 8.1.5    | <a href="#">Field Documentation</a>                           | 20 |
| 8.1.5.1  | <a href="#">active</a>  | 20 |
| 8.1.5.2  | <a href="#">cycle_time</a>                                    | 20 |
| 8.1.5.3  | <a href="#">d_temperature</a>                                 | 20 |
| 8.1.5.4  | <a href="#">dynamic_temperature</a>                           | 20 |
| 8.1.5.5  | <a href="#">emissivity</a>                                    | 20 |
| 8.1.5.6  | <a href="#">facet</a>   | 20 |
| 8.1.5.7  | <a href="#">heat_capacity</a>                                 | 21 |
| 8.1.5.8  | <a href="#">integrable_object</a>                             | 21 |
| 8.1.5.9  | <a href="#">next_temperature</a>                              | 21 |
| 8.1.5.10 | <a href="#">power_absorb</a>                                  | 21 |
| 8.1.5.11 | <a href="#">power_emit</a>                                    | 21 |
| 8.1.5.12 | <a href="#">rad_constant</a>                                  | 21 |
| 8.1.5.13 | <a href="#">stefan_boltzmann</a>                              | 22 |
| 8.1.5.14 | <a href="#">thermal_power_dump</a>                            | 22 |
| 8.2      | <a href="#">jeod::ThermalIntegrableObject Class Reference</a> | 22 |
| 8.2.1    | <a href="#">Detailed Description</a>                          | 23 |
| 8.2.2    | <a href="#">Constructor &amp; Destructor Documentation</a>    | 23 |
| 8.2.2.1  | <a href="#">ThermalIntegrableObject</a>                       | 23 |
| 8.2.2.2  | <a href="#">~ThermalIntegrableObject</a>                      | 24 |
| 8.2.2.3  | <a href="#">ThermalIntegrableObject</a>                       | 24 |
| 8.2.3    | <a href="#">Member Function Documentation</a>                 | 24 |
| 8.2.3.1  | <a href="#">compute_temp_dot</a>                              | 24 |
| 8.2.3.2  | <a href="#">create_integrators</a>                            | 24 |
| 8.2.3.3  | <a href="#">destroy_integrators</a>                           | 24 |
| 8.2.3.4  | <a href="#">get_temp</a>                                      | 24 |
| 8.2.3.5  | <a href="#">get_temp_dot</a>                                  | 24 |
| 8.2.3.6  | <a href="#">initialize</a>                                    | 25 |
| 8.2.3.7  | <a href="#">integrate</a>                                     | 25 |
| 8.2.3.8  | <a href="#">operator=</a>                                     | 25 |

|         |  |    |
|---------|--|----|
| 8.2.3.9 | <a href="#">reset_integrators</a>                          | 25 |
| 8.2.4   | <a href="#">Friends And Related Function Documentation</a> | 25 |
| 8.2.4.1 | <a href="#">init_attrjeod__ThermalIntegrableObject</a>     | 25 |
| 8.2.4.2 | <a href="#">InputProcessor</a>                             | 25 |
| 8.2.5   | <a href="#">Field Documentation</a>                        | 26 |
| 8.2.5.1 | <a href="#">active</a>                                     | 26 |
| 8.2.5.2 | <a href="#">integrator</a>                                 | 26 |
| 8.2.5.3 | <a href="#">rider</a>                                      | 26 |
| 8.2.5.4 | <a href="#">t_pow4</a>                                     | 26 |
| 8.2.5.5 | <a href="#">temp</a>                                       | 26 |
| 8.2.5.6 | <a href="#">temp_dot</a>                                   | 26 |
| 8.3     | <a href="#">jeod::ThermalMessages Class Reference</a>      | 27 |
| 8.3.1   | <a href="#">Detailed Description</a>                       | 27 |
| 8.3.2   | <a href="#">Constructor &amp; Destructor Documentation</a> | 27 |
| 8.3.2.1 | <a href="#">ThermalMessages</a>                            | 27 |
| 8.3.2.2 | <a href="#">ThermalMessages</a>                            | 27 |
| 8.3.3   | <a href="#">Member Function Documentation</a>              | 27 |
| 8.3.3.1 | <a href="#">operator=</a>                                  | 27 |
| 8.3.4   | <a href="#">Friends And Related Function Documentation</a> | 27 |
| 8.3.4.1 | <a href="#">init_attrjeod__ThermalMessages</a>             | 27 |
| 8.3.4.2 | <a href="#">InputProcessor</a>                             | 27 |
| 8.3.5   | <a href="#">Field Documentation</a>                        | 28 |
| 8.3.5.1 | <a href="#">incomplete_setup_error</a>                     | 28 |
| 8.3.5.2 | <a href="#">invalid_integration_operation</a>              | 28 |
| 8.4     | <a href="#">jeod::ThermalModelRider Class Reference</a>    | 28 |
| 8.4.1   | <a href="#">Detailed Description</a>                       | 29 |
| 8.4.2   | <a href="#">Constructor &amp; Destructor Documentation</a> | 29 |
| 8.4.2.1 | <a href="#">ThermalModelRider</a>                          | 29 |
| 8.4.2.2 | <a href="#">~ThermalModelRider</a>                         | 29 |
| 8.4.2.3 | <a href="#">ThermalModelRider</a>                          | 29 |
| 8.4.3   | <a href="#">Member Function Documentation</a>              | 29 |
| 8.4.3.1 | <a href="#">operator=</a>                                  | 29 |
| 8.4.3.2 | <a href="#">update</a>                                     | 29 |
| 8.4.4   | <a href="#">Friends And Related Function Documentation</a> | 29 |
| 8.4.4.1 | <a href="#">init_attrjeod__ThermalModelRider</a>           | 29 |
| 8.4.4.2 | <a href="#">InputProcessor</a>                             | 29 |
| 8.4.5   | <a href="#">Field Documentation</a>                        | 30 |
| 8.4.5.1 | <a href="#">active</a>                                     | 30 |
| 8.4.5.2 | <a href="#">include_internal_thermal_effects</a>           | 30 |
| 8.5     | <a href="#">jeod::ThermalParams Class Reference</a>        | 30 |

|          |   |           |
|----------|---|-----------|
| 8.5.1    | Detailed Description                        | 31        |
| 8.5.2    | Constructor & Destructor Documentation      | 31        |
| 8.5.2.1  | ThermalParams                               | 31        |
| 8.5.2.2  | ~ThermalParams                              | 31        |
| 8.5.2.3  | ThermalParams                               | 31        |
| 8.5.3    | Member Function Documentation               | 31        |
| 8.5.3.1  | operator=                                   | 31        |
| 8.5.4    | Friends And Related Function Documentation  | 31        |
| 8.5.4.1  | init_attrjeod__ThermalParams                | 31        |
| 8.5.4.2  | InputProcessor                              | 31        |
| 8.5.5    | Field Documentation                         | 31        |
| 8.5.5.1  | emissivity                                  | 31        |
| 8.5.5.2  | heat_capacity_per_area                      | 32        |
| 8.5.5.3  | thermal_power_dump                          | 32        |
| <b>9</b> | <b>File Documentation</b>                   | <b>33</b> |
| 9.1      | class_declarations.hh File Reference        | 33        |
| 9.1.1    | Detailed Description                        | 33        |
| 9.2      | thermal_facet_rider.cc File Reference       | 33        |
| 9.2.1    | Detailed Description                        | 34        |
| 9.2.2    | Macro Definition Documentation              | 34        |
| 9.2.2.1  | pow4  | 34        |
| 9.3      | thermal_facet_rider.hh File Reference       | 34        |
| 9.3.1    | Detailed Description                        | 34        |
| 9.4      | thermal_integrable_object.cc File Reference | 34        |
| 9.4.1    | Detailed Description                        | 35        |
| 9.5      | thermal_integrable_object.hh File Reference | 35        |
| 9.5.1    | Detailed Description                        | 35        |
| 9.6      | thermal_messages.cc File Reference          | 35        |
| 9.6.1    | Detailed Description                        | 35        |
| 9.7      | thermal_messages.hh File Reference          | 36        |
| 9.7.1    | Detailed Description                        | 36        |
| 9.8      | thermal_model_rider.cc File Reference       | 36        |
| 9.8.1    | Detailed Description                        | 36        |
| 9.9      | thermal_model_rider.hh File Reference       | 36        |
| 9.9.1    | Detailed Description                        | 37        |
| 9.10     | thermal_params.cc File Reference            | 37        |
| 9.10.1   | Detailed Description                        | 37        |
| 9.11     | thermal_params.hh File Reference            | 37        |
| 9.11.1   | Detailed Description                        | 38        |







# Chapter 1

## Module Index

### 1.1 Modules

Here is a list of all modules:

|                        |    |
|------------------------|----|
| Models . . . . .       | 11 |
| Interactions . . . . . | 12 |
| ThermalRider . . . . . | 13 |



## Chapter 2

# Namespace Index

### 2.1 Namespace List

Here is a list of all namespaces with brief descriptions:

|                      |                          |    |
|----------------------|--------------------------|----|
| <a href="#">jeod</a> | Namespace jeod . . . . . | 15 |
|----------------------|--------------------------|----|



## Chapter 3

# Hierarchical Index

### 3.1 Class Hierarchy

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

|   |                    |
|---|--------------------|
| IntegrableObject                        |                    |
| jeod::ThermalIntegrableObject . . . . . | <a href="#">22</a> |
| jeod::ThermalFacetRider . . . . .       | <a href="#">17</a> |
| jeod::ThermalMessages . . . . .         | <a href="#">27</a> |
| jeod::ThermalModelRider . . . . .       | <a href="#">28</a> |
| jeod::ThermalParams . . . . .           | <a href="#">30</a> |



## Chapter 4

# Data Structure Index

### 4.1 Data Structures

Here are the data structures with brief descriptions:

|   |  |    |
|---|--|----|
| <a href="#">jeod::ThermalFacetRider</a>       | Defining the thermal characteristics of surface facets . . . . .   | 17 |
| <a href="#">jeod::ThermalIntegrableObject</a> | Encapsulates a thermal integrator for a facet . . . . .  | 22 |
| <a href="#">jeod::ThermalMessages</a>         | Specifying the message IDs used in the model . . . . .   | 27 |
| <a href="#">jeod::ThermalModelRider</a>       | Defining the thermal functionality . . . . .   | 28 |
| <a href="#">jeod::ThermalParams</a>           | A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys . . . . . | 30 |





## Chapter 5

# File Index

### 5.1 File List

Here is a list of all files with brief descriptions:

|  |  |    |
|--|--|----|
| <a href="#">class_declarations.hh</a>        | Forward declaration of classes defined in Thermal_rider model . . . . .  | 33 |
| <a href="#">thermal_facet_rider.cc</a>       | ThermalFacetRider interaction model . . . . .  | 33 |
| <a href="#">thermal_facet_rider.hh</a>       | Defining the thermal characteristics of surface facets . . . . .   | 34 |
| <a href="#">thermal_integrable_object.cc</a> | Encapsulates an integrator for a single facet . . . . .  | 34 |
| <a href="#">thermal_integrable_object.hh</a> | Define an IntegrableObject class adapted to thermal integration . . . . .  | 35 |
| <a href="#">thermal_messages.cc</a>          | Implement the class ThermalMessages . . . . .  | 35 |
| <a href="#">thermal_messages.hh</a>          | Define the class ThermalMessages, the class that specifies the message IDs used in the model   | 36 |
| <a href="#">thermal_model_rider.cc</a>       | ThermalModelRider interaction model . . . . .  | 36 |
| <a href="#">thermal_model_rider.hh</a>       | Defining the thermal functionality . . . . .   | 36 |
| <a href="#">thermal_params.cc</a>            | Thermal Parameter definition . . . . .   | 37 |
| <a href="#">thermal_params.hh</a>            | A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys . . . . . | 37 |



## Chapter 6

# Module Documentation

### 6.1 Models

#### Modules

- [Interactions](#)

#### 6.1.1 Detailed Description

## 6.2 Interactions

### Modules

- [ThermalRider](#)

### 6.2.1 Detailed Description

## 6.3 ThermalRider

### Files

- file [class\\_declarations.hh](#)  
*Forward declaration of classes defined in Thermal\_rider model.*
- file [thermal\\_facet\\_rider.hh](#)  
*Defining the thermal characteristics of surface facets.*
- file [thermal\\_integrable\\_object.hh](#)  
*Define an IntegrableObject class adapted to thermal integration.*
- file [thermal\\_messages.hh](#)  
*Define the class ThermalMessages, the class that specifies the message IDs used in the model.*
- file [thermal\\_model\\_rider.hh](#)  
*Defining the thermal functionality.*
- file [thermal\\_params.hh](#)  
*A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys.*
- file [thermal\\_facet\\_rider.cc](#)  
*ThermalFacetRider interaction model.*
- file [thermal\\_integrable\\_object.cc](#)  
*Encapsulates an integrator for a single facet.*
- file [thermal\\_messages.cc](#)  
*Implement the class ThermalMessages.*
- file [thermal\\_model\\_rider.cc](#)  
*ThermalModelRider interaction model.*
- file [thermal\\_params.cc](#)  
*Thermal Parameter definition.*

### Namespaces

- [jeod](#)  
*Namespace jeod.*

### Macros

- `#define PATH "utils/thermal_rider/"`

#### 6.3.1 Detailed Description

#### 6.3.2 Macro Definition Documentation

##### 6.3.2.1 `#define PATH "utils/thermal_rider/"`

Definition at line 39 of file `thermal_messages.cc`.



## Chapter 7

# Namespace Documentation

### 7.1 jeod Namespace Reference

Namespace jeod.

#### Data Structures

- class [ThermalFacetRider](#)  
*Defining the thermal characteristics of surface facets.*
- class [ThermalIntegrableObject](#)  
*Encapsulates a thermal integrator for a facet.*
- class [ThermalMessages](#)  
*Specifying the message IDs used in the model.*
- class [ThermalModelRider](#)  
*Defining the thermal functionality.*
- class [ThermalParams](#)  
*A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys.*

#### 7.1.1 Detailed Description

Namespace jeod.





## Chapter 8

# Data Structure Documentation

### 8.1 jeod::ThermalFacetRider Class Reference

Defining the thermal characteristics of surface facets.

```
#include <thermal_facet_rider.hh>
```

#### Public Member Functions

- [ThermalFacetRider](#) ()  
*Constructor.*
- virtual [~ThermalFacetRider](#) ()  
*Destructor.*
- void [initialize](#) (double temperature, double surface\_area)  
*Initialize the thermal aspects of the facet.*
- void [accumulate\\_thermal\\_sources](#) (void)  
*Collects together all surface and internal thermal sources that affect a facet.*
- double [integrate](#) (void)  
*Runge-Kutta 4th order integration of the temperature variation.*

#### Data Fields

- double [d\\_temperature](#)  
*Change in temperature.*
- double [power\\_absorb](#)  
*Rate at which energy is absorbed from the environment, vehicle, and surface.*
- double [power\\_emit](#)  
*Rate at which energy is thermally radiated from the facet.*
- double [heat\\_capacity](#)  
*Heat capacity of the facet.*
- double [rad\\_constant](#)  
*Combination of variables that are held constant for any given facet.*
- InteractionFacet \* [facet](#)  
*Pointer back to facet that contains this thermal rider.*
- bool [active](#)  
*Flag set to indicate whether the facet to which this rider is attached has a dynamic temperature variability.*
- double [thermal\\_power\\_dump](#)

*Rate at which thermal energy is transferred to the facet from within the vehicle.*

- double [emissivity](#)

*Fraction of  $\sigma \cdot T^4$  (potential for emissive radiation) that is actually emitted.*

- [ThermalIntegrableObject](#) [integrable\\_object](#)

*The encapsulation of a first order integrator which can optionally be used to integrate the temperature.*

## Static Public Attributes

- static double [cycle\\_time](#) = 0.0

*Time since the last temperature calculation for the particular model under consideration.*

## Static Protected Attributes

- static const double [stefan\\_boltzmann](#) = 5.6704004E-08

*Stefan-Boltzmann constant.*

## Private Member Functions

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

## Private Attributes

- double [next\\_temperature](#)

*The predicted value of temperature at the next time-step.*

- double [dynamic\\_temperature](#)

*The dynamic value of the facet kinetic temperature.*

## Friends

- class [InputProcessor](#)
- void [init\\_attrjeod\\_\\_ThermalFacetRider](#) ()

### 8.1.1 Detailed Description

Defining the thermal characteristics of surface facets.

Definition at line 50 of file `thermal_facet_rider.hh`.

### 8.1.2 Constructor & Destructor Documentation

#### 8.1.2.1 `jeod::ThermalFacetRider::ThermalFacetRider ( void )`

Constructor.

Definition at line 63 of file `thermal_facet_rider.cc`.

References `active`, `d_temperature`, `dynamic_temperature`, `emissivity`, `facet`, `heat_capacity`, `next_temperature`, `power_absorb`, `power_emit`, `rad_constant`, and `thermal_power_dump`.

### 8.1.2.2 jeod::ThermalFacetRider::~~ThermalFacetRider ( void ) [virtual]

Destructor.

Definition at line 316 of file thermal\_facet\_rider.cc.

### 8.1.2.3 jeod::ThermalFacetRider::ThermalFacetRider ( const ThermalFacetRider & rhs ) [private]

## 8.1.3 Member Function Documentation

### 8.1.3.1 void jeod::ThermalFacetRider::accumulate\_thermal\_sources ( void )

Collects together all surface and internal thermal sources that affect a facet.

Definition at line 85 of file thermal\_facet\_rider.cc.

References power\_absorb, power\_emit, and thermal\_power\_dump.

### 8.1.3.2 void jeod::ThermalFacetRider::initialize ( double temperature, double surface\_area )

Initialize the thermal aspects of the facet.

Parameters

|    |                     |                                     |
|----|---------------------|-------------------------------------|
| in | <i>temperature</i>  | temperature of facet<br>Units: K    |
| in | <i>surface_area</i> | area of facet surface<br>Units: M*M |

Definition at line 141 of file thermal\_facet\_rider.cc.

References dynamic\_temperature, emissivity, jeod::ThermalMessages::incomplete\_setup\_error, jeod::ThermalIntegrableObject::initialize(), integrable\_object, next\_temperature, rad\_constant, and stefan\_boltzmann.

### 8.1.3.3 double jeod::ThermalFacetRider::integrate ( void )

Runge-Kutta 4th order integration of the temperature variation.

Returns

void

Definition at line 187 of file thermal\_facet\_rider.cc.

References active, cycle\_time, d\_temperature, dynamic\_temperature, heat\_capacity, jeod::ThermalMessages::invalid\_integration\_operation, next\_temperature, pow4, power\_absorb, power\_emit, and rad\_constant.

### 8.1.3.4 ThermalFacetRider& jeod::ThermalFacetRider::operator= ( const ThermalFacetRider & rhs ) [private]

## 8.1.4 Friends And Related Function Documentation

### 8.1.4.1 void init\_attrjeod\_\_ThermalFacetRider ( ) [friend]

### 8.1.4.2 friend class InputProcessor [friend]

Definition at line 52 of file thermal\_facet\_rider.hh.

### 8.1.5 Field Documentation

#### 8.1.5.1 `bool jeod::ThermalFacetRider::active`

Flag set to indicate whether the facet to which this rider is attached has a dynamic temperature variability.

trick\_units(—)

Definition at line 109 of file `thermal_facet_rider.hh`.

Referenced by `integrate()`, and `ThermalFacetRider()`.

#### 8.1.5.2 `double jeod::ThermalFacetRider::cycle_time = 0.0` `[static]`

Time since the last temperature calculation for the particular model under consideration.

trick\_units(s)

Definition at line 62 of file `thermal_facet_rider.hh`.

Referenced by `integrate()`, and `jeod::ThermalModelRider::update()`.

#### 8.1.5.3 `double jeod::ThermalFacetRider::d_temperature`

Change in temperature.

trick\_units(—)

Definition at line 67 of file `thermal_facet_rider.hh`.

Referenced by `integrate()`, and `ThermalFacetRider()`.

#### 8.1.5.4 `double jeod::ThermalFacetRider::dynamic_temperature` `[private]`

The dynamic value of the facet kinetic temperature.

THIS VALUE IS USED ONLY BY THE THERMAL INTEGRATOR, AND SHOULD NOT BE SET EXTERNALLY.-

trick\_units(K)

Definition at line 152 of file `thermal_facet_rider.hh`.

Referenced by `initialize()`, `integrate()`, and `ThermalFacetRider()`.

#### 8.1.5.5 `double jeod::ThermalFacetRider::emissivity`

Fraction of  $\sigma T^4$  (potential for emissive radiation) that is actually emitted.

trick\_units(—)

Definition at line 125 of file `thermal_facet_rider.hh`.

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

#### 8.1.5.6 `InteractionFacet* jeod::ThermalFacetRider::facet`

Pointer back to facet that contains this thermal rider.

trick\_units(—)

Definition at line 101 of file `thermal_facet_rider.hh`.

Referenced by `ThermalFacetRider()`.

**8.1.5.7 double jeod::ThermalFacetRider::heat\_capacity**

Heat capacity of the facet.

trick\_units(—)

Definition at line 87 of file thermal\_facet\_rider.hh.

Referenced by jeod::ThermalIntegrableObject::compute\_temp\_dot(), integrate(), and ThermalFacetRider().

**8.1.5.8 ThermalIntegrableObject jeod::ThermalFacetRider::integrable\_object**

The encapsulation of a first order integrator which can optionally be used to integrate the temperature.

trick\_units(—)

Definition at line 131 of file thermal\_facet\_rider.hh.

Referenced by initialize().

**8.1.5.9 double jeod::ThermalFacetRider::next\_temperature [private]**

The predicted value of temperature at the next time-step.

THIS VALUE IS USED ONLY BY THE THERMAL INTEGRATOR, AND SHOULD NOT BE SET EXTERNALLY.-

trick\_units(K)

Definition at line 146 of file thermal\_facet\_rider.hh.

Referenced by initialize(), integrate(), and ThermalFacetRider().

**8.1.5.10 double jeod::ThermalFacetRider::power\_absorb**

Rate at which energy is absorbed from the environment, vehicle, and surface.

trick\_units(—)

Definition at line 73 of file thermal\_facet\_rider.hh.

Referenced by accumulate\_thermal\_sources(), jeod::ThermalIntegrableObject::compute\_temp\_dot(), jeod::ThermalIntegrableObject::integrate(), integrate(), and ThermalFacetRider().

**8.1.5.11 double jeod::ThermalFacetRider::power\_emit**

Rate at which energy is thermally radiated from the facet.

trick\_units(—)

Definition at line 78 of file thermal\_facet\_rider.hh.

Referenced by accumulate\_thermal\_sources(), jeod::ThermalIntegrableObject::compute\_temp\_dot(), integrate(), and ThermalFacetRider().

**8.1.5.12 double jeod::ThermalFacetRider::rad\_constant**

Combination of variables that are held constant for any given facet.

trick\_units(—)

Definition at line 96 of file thermal\_facet\_rider.hh.

Referenced by jeod::ThermalIntegrableObject::compute\_temp\_dot(), initialize(), jeod::ThermalIntegrableObject::integrate(), integrate(), and ThermalFacetRider().

**8.1.5.13** `const double jeod::ThermalFacetRider::stefan_boltzmann = 5.6704004E-08` `[static], [protected]`

Stefan-Boltzmann constant.

`trick_io(*o) trick_units(-)`

Definition at line 138 of file `thermal_facet_rider.hh`.

Referenced by `initialize()`.

**8.1.5.14** `double jeod::ThermalFacetRider::thermal_power_dump`

Rate at which thermal energy is transfered to the facet from within the vehicle.

`trick_units(-)`

Definition at line 115 of file `thermal_facet_rider.hh`.

Referenced by `accumulate_thermal_sources()`, and `ThermalFacetRider()`.

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

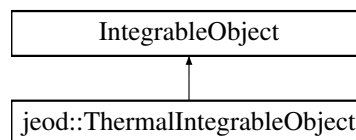
- [thermal\\_facet\\_rider.hh](#)
- [thermal\\_facet\\_rider.cc](#)

## 8.2 jeod::ThermalIntegrableObject Class Reference

Encapsulates a thermal integrator for a facet.

`#include <thermal_integrableObject.hh>`

Inheritance diagram for `jeod::ThermalIntegrableObject`:



### Public Member Functions

- [ThermalIntegrableObject](#) ()  
*ThermalIntegrableObject default constructor.*
- virtual [~ThermalIntegrableObject](#) ()  
*ThermalIntegrableObject destructor.*
- void [initialize](#) (double temperature, [ThermalFacetRider](#) &associated\_rider)  
*Initialize temperature and cache a pointer to the ThermalFacetRider.*
- virtual void [create\\_integrators](#) (const er7\_utils::IntegratorConstructor &generator, er7\_utils::IntegrationControls &controls, const er7\_utils::TimeInterface &time\_if)  
*Create the first order integrator for this IntegrableObject.*
- virtual void [destroy\\_integrators](#) ()  
*Destroy integrators for this IntegrableObject.*
- virtual void [reset\\_integrators](#) ()  
*Reset the integrator.*
- virtual er7\_utils::IntegratorResult [integrate](#) (double dyn\_dt, unsigned int target\_stage)  
*Integrate the thermal state.*
- void [compute\\_temp\\_dot](#) ()

*Compute emitted power and the time derivative of temperature.*

- double [get\\_temp](#) ()  
*Get the temperature.*
- double [get\\_temp\\_dot](#) ()  
*Get the temperature time derivative.*

## Data Fields

- bool [active](#)  
*If true, this IntegrableObject will integrate temperature.*

## Private Member Functions

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

## Private Attributes

- RestartableScalarFirstOrderODEIntegrator [integrator](#)  
*Integrates temperature on one facet.*
- [ThermalFacetRider](#) \* [rider](#)  
*Cached pointer to the associated [ThermalFacetRider](#).*
- double [temp](#)  
*Temperature of the facet.*
- double [temp\\_dot](#)  
*Time derivative of temperature.*
- double [t\\_pow4](#)  
*Fourth power of current temperature.*

## Friends

- class [InputProcessor](#)
- void [init\\_attrjeod\\_\\_ThermalIntegrableObject](#) ()

### 8.2.1 Detailed Description

Encapsulates a thermal integrator for a facet.

Definition at line 52 of file thermal\_integrable\_object.hh.

### 8.2.2 Constructor & Destructor Documentation

#### 8.2.2.1 [jeod::ThermalIntegrableObject::ThermalIntegrableObject](#) ( )

[ThermalIntegrableObject](#) default constructor.

Definition at line 48 of file thermal\_integrable\_object.cc.

References [integrator](#).

**8.2.2.2** `jeod::ThermalIntegrableObject::~~ThermalIntegrableObject ( ) [virtual]`

[ThermalIntegrableObject](#) destructor.

Definition at line 61 of file `thermal_integrable_object.cc`.

References `destroy_integrators()`, and `integrator`.

**8.2.2.3** `jeod::ThermalIntegrableObject::ThermalIntegrableObject ( const ThermalIntegrableObject & rhs ) [private]`

### 8.2.3 Member Function Documentation

**8.2.3.1** `void jeod::ThermalIntegrableObject::compute_temp_dot ( void )`

Compute emitted power and the time derivative of temperature.

Definition at line 164 of file `thermal_integrable_object.cc`.

References `jeod::ThermalFacetRider::heat_capacity`, `jeod::ThermalFacetRider::power_absorb`, `jeod::ThermalFacetRider::power_emit`, `jeod::ThermalFacetRider::rad_constant`, `rider`, `t_pow4`, and `temp_dot`.

**8.2.3.2** `void jeod::ThermalIntegrableObject::create_integrators ( const er7_utils::IntegratorConstructor & generator, er7_utils::IntegrationControls & controls, const er7_utils::TimeInterface & time_if ) [virtual]`

Create the first order integrator for this `IntegrableObject`.

Parameters

|                  |  |
|------------------|--|
| <i>generator</i> | Integrator constructor that creates the integrator.  |
| <i>controls</i>  | Integration controls that mediates the integrations. |
| <i>time_if</i>   | Unused.  |

Definition at line 75 of file `thermal_integrable_object.cc`.

References `integrator`.

**8.2.3.3** `void jeod::ThermalIntegrableObject::destroy_integrators ( void ) [virtual]`

Destroy integrators for this `IntegrableObject`.

Definition at line 88 of file `thermal_integrable_object.cc`.

Referenced by `~ThermalIntegrableObject()`.

**8.2.3.4** `double jeod::ThermalIntegrableObject::get_temp ( ) [inline]`

Get the temperature.

Returns

Facet temperature.

Definition at line 90 of file `thermal_integrable_object.hh`.

References `temp`.

**8.2.3.5** `double jeod::ThermalIntegrableObject::get_temp_dot ( ) [inline]`

Get the temperature time derivative.



**Returns**

Facet temperature time derivative.

Definition at line 99 of file thermal\_integrable\_object.hh.

References temp\_dot.

### 8.2.3.6 void jeod::ThermalIntegrableObject::initialize ( double *temperature*, ThermalFacetRider & *associated\_rider* )

Initialize temperature and cache a pointer to the [ThermalFacetRider](#).

**Parameters**

|                         |  |
|-------------------------|--|
| <i>temperature</i>      | – initial temperature                              |
| <i>associated_rider</i> | – the associated <a href="#">ThermalFacetRider</a> |

Definition at line 149 of file thermal\_integrable\_object.cc.

References rider, t\_pow4, and temp.

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

### 8.2.3.7 er7\_utils::IntegratorResult jeod::ThermalIntegrableObject::integrate ( double *dyn\_dt*, unsigned int *target\_stage* ) [virtual]

Integrate the thermal state.

**Parameters**

|    |                     |  |
|----|---------------------|--|
| in | <i>dyn_dt</i>       | Dynamic time step, in dynamic time seconds.                                    |
| in | <i>target_stage</i> | The stage of the integration process that the integrator should try to attain. |

**Returns**

The status (time advance, pass/fail status) of the integration.

Definition at line 114 of file thermal\_integrable\_object.cc.

References integrator, jeod::ThermalMessages::invalid\_integration\_operation, jeod::ThermalFacetRider::power\_ - absorb, jeod::ThermalFacetRider::rad\_constant, rider, t\_pow4, temp, and temp\_dot.

### 8.2.3.8 ThermalIntegrableObject& jeod::ThermalIntegrableObject::operator= ( const ThermalIntegrableObject & *rhs* ) [private]

### 8.2.3.9 void jeod::ThermalIntegrableObject::reset\_integrators ( void ) [virtual]

Reset the integrator.

Definition at line 99 of file thermal\_integrable\_object.cc.

References integrator.

## 8.2.4 Friends And Related Function Documentation

### 8.2.4.1 void init\_attrjeod\_\_ThermalIntegrableObject ( ) [friend]

### 8.2.4.2 friend class InputProcessor [friend]

Definition at line 54 of file thermal\_integrable\_object.hh.

## 8.2.5 Field Documentation

### 8.2.5.1 `bool jeod::ThermalIntegrableObject::active`

If true, this IntegrableObject will integrate temperature.

`trick_units(-)`

Definition at line 110 of file `thermal_integrable_object.hh`.

### 8.2.5.2 `RestartableScalarFirstOrderODEIntegrator jeod::ThermalIntegrableObject::integrator` `[private]`

Integrates temperature on one facet.

`trick_units(-)`

Definition at line 118 of file `thermal_integrable_object.hh`.

Referenced by `create_integrators()`, `integrate()`, `reset_integrators()`, `ThermalIntegrableObject()`, and `~ThermalIntegrableObject()`.

### 8.2.5.3 `ThermalFacetRider* jeod::ThermalIntegrableObject::rider` `[private]`

Cached pointer to the associated [ThermalFacetRider](#).

`trick_units(-)`

Definition at line 123 of file `thermal_integrable_object.hh`.

Referenced by `compute_temp_dot()`, `initialize()`, and `integrate()`.

### 8.2.5.4 `double jeod::ThermalIntegrableObject::t_pow4` `[private]`

Fourth power of current temperature.

`trick_units(K*K*K*K)`

Definition at line 138 of file `thermal_integrable_object.hh`.

Referenced by `compute_temp_dot()`, `initialize()`, and `integrate()`.

### 8.2.5.5 `double jeod::ThermalIntegrableObject::temp` `[private]`

Temperature of the facet.

`trick_units(K)`

Definition at line 128 of file `thermal_integrable_object.hh`.

Referenced by `get_temp()`, `initialize()`, and `integrate()`.

### 8.2.5.6 `double jeod::ThermalIntegrableObject::temp_dot` `[private]`

Time derivative of temperature.

`trick_units(K/s)`

Definition at line 133 of file `thermal_integrable_object.hh`.

Referenced by `compute_temp_dot()`, `get_temp_dot()`, and `integrate()`.

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

- [thermal\\_integrable\\_object.hh](#)

- [thermal\\_integrable\\_object.cc](#)

## 8.3 jeod::ThermalMessages Class Reference

Specifying the message IDs used in the model.

```
#include <thermal_messages.hh>
```

### Static Public Attributes

- static char const \* [incomplete\\_setup\\_error](#)  
*Generic error; the model was not set up correctly.*
- static char const \* [invalid\\_integration\\_operation](#)  
*The integration is invalid, usually because the integration step is too large.*

### Private Member Functions

- [ThermalMessages](#) (void)
- [ThermalMessages](#) (const [ThermalMessages](#) &)
- [ThermalMessages](#) & [operator=](#) (const [ThermalMessages](#) &)

### Friends

- class [InputProcessor](#)
- void [init\\_attrjeod\\_\\_ThermalMessages](#) ()

#### 8.3.1 Detailed Description

Specifying the message IDs used in the model.

Definition at line 47 of file `thermal_messages.hh`.

#### 8.3.2 Constructor & Destructor Documentation

8.3.2.1 `jeod::ThermalMessages::ThermalMessages ( void )` `[private]`

8.3.2.2 `jeod::ThermalMessages::ThermalMessages ( const ThermalMessages & )` `[private]`

#### 8.3.3 Member Function Documentation

8.3.3.1 `ThermalMessages& jeod::ThermalMessages::operator= ( const ThermalMessages & )` `[private]`

#### 8.3.4 Friends And Related Function Documentation

8.3.4.1 `void init_attrjeod__ThermalMessages ( )` `[friend]`

8.3.4.2 `friend class InputProcessor` `[friend]`

Definition at line 50 of file `thermal_messages.hh`.

### 8.3.5 Field Documentation

#### 8.3.5.1 `char const * jeod::ThermalMessages::incomplete_setup_error` `[static]`

##### Initial value:

```
=
    "utils/thermal_rider/" "incomplete_setup_error"
```

Generic error; the model was not set up correctly.

trick\_units(-)

Definition at line 59 of file thermal\_messages.hh.

Referenced by `jeod::ThermalFacetRider::initialize()`.

#### 8.3.5.2 `char const * jeod::ThermalMessages::invalid_integration_operation` `[static]`

##### Initial value:

```
=
    "utils/thermal_rider/" "invalid_integration_operation"
```

The integration is invalid, usually because the integration step is too large.

trick\_units(-)

Definition at line 66 of file thermal\_messages.hh.

Referenced by `jeod::ThermalIntegrableObject::integrate()`, and `jeod::ThermalFacetRider::integrate()`.

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

- [thermal\\_messages.hh](#)
- [thermal\\_messages.cc](#)

## 8.4 `jeod::ThermalModelRider` Class Reference

Defining the thermal functionality.

```
#include <thermal_model_rider.hh>
```

### Public Member Functions

- [ThermalModelRider](#) ()  
*Constructor.*
- virtual [~ThermalModelRider](#) ()  
*Destructor.*
- void [update](#) (InteractionSurface \*surface\_ptr)  
*update the thermal aspects of all facets*

### Data Fields

- bool [active](#)  
*Flag to allow thermal variation of facets.*
- bool [include\\_internal\\_thermal\\_effects](#)  
*Flag to include facet-to-facet conduction, and vehicle-to-facet thermal sources and sinks.*

## Private Member Functions

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

## Friends

- class [InputProcessor](#)
- void [init\\_attrjeod\\_\\_ThermalModelRider](#) ()

### 8.4.1 Detailed Description

Defining the thermal functionality.

Definition at line 49 of file `thermal_model_rider.hh`.

### 8.4.2 Constructor & Destructor Documentation

#### 8.4.2.1 `jeod::ThermalModelRider::ThermalModelRider ( void )`

Constructor.

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

References `active`, and `include_internal_thermal_effects`.

#### 8.4.2.2 `jeod::ThermalModelRider::~~ThermalModelRider ( void )` `[virtual]`

Destructor.

Definition at line 83 of file `thermal_model_rider.cc`.

#### 8.4.2.3 `jeod::ThermalModelRider::ThermalModelRider ( const ThermalModelRider & rhs )` `[private]`

### 8.4.3 Member Function Documentation

#### 8.4.3.1 `ThermalModelRider& jeod::ThermalModelRider::operator= ( const ThermalModelRider & rhs )` `[private]`

#### 8.4.3.2 `void jeod::ThermalModelRider::update ( InteractionSurface * surface_ptr )`

update the thermal aspects of all facets

Parameters

|                 |                          |                      |
|-----------------|--------------------------|----------------------|
| <code>in</code> | <code>surface_ptr</code> | pointer the surface. |
|-----------------|--------------------------|----------------------|

Definition at line 65 of file `thermal_model_rider.cc`.

References `active`, `jeod::ThermalFacetRider::cycle_time`, and `include_internal_thermal_effects`.

### 8.4.4 Friends And Related Function Documentation

#### 8.4.4.1 `void init_attrjeod__ThermalModelRider ( )` `[friend]`

#### 8.4.4.2 `friend class InputProcessor` `[friend]`

Definition at line 51 of file `thermal_model_rider.hh`.

### 8.4.5 Field Documentation

#### 8.4.5.1 `bool jeod::ThermalModelRider::active`

Flag to allow thermal variation of facets.

`trick_units(-)`

Definition at line 57 of file `thermal_model_rider.hh`.

Referenced by `ThermalModelRider()`, and `update()`.

#### 8.4.5.2 `bool jeod::ThermalModelRider::include_internal_thermal_effects`

Flag to include facet-to-facet conduction, and vehicle-to-facet thermal sources and sinks.

`trick_units(-)`

Definition at line 63 of file `thermal_model_rider.hh`.

Referenced by `ThermalModelRider()`, and `update()`.

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

- [thermal\\_model\\_rider.hh](#)
- [thermal\\_model\\_rider.cc](#)

## 8.5 `jeod::ThermalParams` Class Reference

A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective `InteractionSurfaceFactory`s.

```
#include <thermal_params.hh>
```

### Public Member Functions

- [ThermalParams](#) ()  
*Constructor.*
- virtual [~ThermalParams](#) ()  
*Destructor.*

### Data Fields

- double [emissivity](#)  
*Fraction of  $\sigma \cdot T^4$  (potential for emissive thermal) that is actually emitted.*
- double [heat\\_capacity\\_per\\_area](#)  
*Heat Capacity per unit area of surface.*
- double [thermal\\_power\\_dump](#)  
*Rate at which thermal energy is dumped (positive) / extracted (negative) into a facet from within the vehicle.*

### Private Member Functions

- [ThermalParams](#) & `operator=` (const [ThermalParams](#) &rhs)
- [ThermalParams](#) (const [ThermalParams](#) &rhs)

## Friends

- class [InputProcessor](#)
- void [init\\_attrjeod\\_\\_ThermalParams](#) ()

### 8.5.1 Detailed Description

A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys.

Definition at line 50 of file thermal\_params.hh.

### 8.5.2 Constructor & Destructor Documentation

#### 8.5.2.1 jeod::ThermalParams::ThermalParams ( void )

Constructor.

Definition at line 48 of file thermal\_params.cc.

References `emissivity`, `heat_capacity_per_area`, and `thermal_power_dump`.

#### 8.5.2.2 jeod::ThermalParams::~~ThermalParams ( void ) [virtual]

Destructor.

Definition at line 59 of file thermal\_params.cc.

#### 8.5.2.3 jeod::ThermalParams::ThermalParams ( const ThermalParams & rhs ) [private]

### 8.5.3 Member Function Documentation

#### 8.5.3.1 ThermalParams& jeod::ThermalParams::operator= ( const ThermalParams & rhs ) [private]

### 8.5.4 Friends And Related Function Documentation

#### 8.5.4.1 void init\_attrjeod\_\_ThermalParams ( ) [friend]

#### 8.5.4.2 friend class InputProcessor [friend]

Definition at line 51 of file thermal\_params.hh.

### 8.5.5 Field Documentation

#### 8.5.5.1 double jeod::ThermalParams::emissivity

Fraction of  $\sigma T^4$  (potential for emissive thermal) that is actually emitted.

`trick_units(-)`

Definition at line 59 of file thermal\_params.hh.

Referenced by `ThermalParams()`.

#### 8.5.5.2 `double jeod::ThermalParams::heat_capacity_per_area`

Heat Capacity per unit area of surface.

`trick_units(-)`

Definition at line 64 of file `thermal_params.hh`.

Referenced by `ThermalParams()`.

#### 8.5.5.3 `double jeod::ThermalParams::thermal_power_dump`

Rate at which thermal energy is dumped (positive) / extracted (negative) into a facet from within the vehicle.

Used for radiators and the like.`trick_units(-)`

Definition at line 71 of file `thermal_params.hh`.

Referenced by `ThermalParams()`.

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

- [thermal\\_params.hh](#)
- [thermal\\_params.cc](#)



## Chapter 9

# File Documentation

### 9.1 `class_declarations.hh` File Reference

Forward declaration of classes defined in Thermal\_rider model.

#### Namespaces

- [jeod](#)

*Namespace jeod.*

#### 9.1.1 Detailed Description

Forward declaration of classes defined in Thermal\_rider model.

Definition in file [class\\_declarations.hh](#).

### 9.2 `thermal_facet_rider.cc` File Reference

ThermalFacetRider interaction model.

```
#include <cstdint>
#include <cmath>
#include "utils/message/include/message_handler.hh"
#include "../include/thermal_facet_rider.hh"
#include "../include/thermal_messages.hh"
```

#### Namespaces

- [jeod](#)

*Namespace jeod.*

#### Macros

- `#define pow4(x) pow4_temp = (x) * (x), pow4_temp *= pow4_temp`

### 9.2.1 Detailed Description

ThermalFacetRider interaction model.

Definition in file [thermal\\_facet\\_rider.cc](#).

### 9.2.2 Macro Definition Documentation

9.2.2.1 `#define pow4( x ) pow4_temp = (x) * (x), pow4_temp *= pow4_temp`

Referenced by `jeod::ThermalFacetRider::integrate()`.

## 9.3 thermal\_facet\_rider.hh File Reference

Defining the thermal characteristics of surface facets.

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

### Data Structures

- class [jeod::ThermalFacetRider](#)  
*Defining the thermal characteristics of surface facets.*

### Namespaces

- [jeod](#)  
*Namespace jeod.*

### 9.3.1 Detailed Description

Defining the thermal characteristics of surface facets.

Definition in file [thermal\\_facet\\_rider.hh](#).

## 9.4 thermal\_integrable\_object.cc File Reference

Encapsulates an integrator for a single facet.

```
#include <cmath>
#include "../include/thermal_facet_rider.hh"
#include "../include/thermal_integrable_object.hh"
#include "../include/thermal_messages.hh"
```

### Namespaces

- [jeod](#)  
*Namespace jeod.*

### 9.4.1 Detailed Description

Encapsulates an integrator for a single facet.

Definition in file [thermal\\_integrable\\_object.cc](#).

## 9.5 thermal\_integrable\_object.hh File Reference

Define an IntegrableObject class adapted to thermal integration.

```
#include "er7_utils/integration/core/include/integrable_object.hh"
#include "er7_utils/integration/core/include/integrator_result.hh"
#include "utils/integration/include/restartable_state_integrator.hh"
#include "utils/sim_interface/include/jeod_class.hh"
```

### Data Structures

- class [jeod::ThermalIntegrableObject](#)  
*Encapsulates a thermal integrator for a facet.*

### Namespaces

- [jeod](#)  
*Namespace jeod.*

### 9.5.1 Detailed Description

Define an IntegrableObject class adapted to thermal integration.

Definition in file [thermal\\_integrable\\_object.hh](#).

## 9.6 thermal\_messages.cc File Reference

Implement the class ThermalMessages.

```
#include "../include/thermal_messages.hh"
```

### Namespaces

- [jeod](#)  
*Namespace jeod.*

### Macros

- `#define` [PATH](#) "utils/thermal\_rider/"

### 9.6.1 Detailed Description

Implement the class ThermalMessages.

Definition in file [thermal\\_messages.cc](#).

## 9.7 thermal\_messages.hh File Reference

Define the class ThermalMessages, the class that specifies the message IDs used in the model.

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

### Data Structures

- class [jeod::ThermalMessages](#)  
*Specifying the message IDs used in the model.*

### Namespaces

- [jeod](#)  
*Namespace jeod.*

#### 9.7.1 Detailed Description

Define the class ThermalMessages, the class that specifies the message IDs used in the model.

Definition in file [thermal\\_messages.hh](#).

## 9.8 thermal\_model\_rider.cc File Reference

ThermalModelRider interaction model.

```
#include "../include/thermal_model_rider.hh"  
#include "utils/surface_model/include/interaction_surface.hh"  
#include "../include/thermal_facet_rider.hh"
```

### Namespaces

- [jeod](#)  
*Namespace jeod.*

#### 9.8.1 Detailed Description

ThermalModelRider interaction model.

Definition in file [thermal\\_model\\_rider.cc](#).

## 9.9 thermal\_model\_rider.hh File Reference

Defining the thermal functionality.

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

## Data Structures

- class [jeod::ThermalModelRider](#)  
*Defining the thermal functionality.*

## Namespaces

- [jeod](#)  
*Namespace jeod.*

### 9.9.1 Detailed Description

Defining the thermal functionality.

Definition in file [thermal\\_model\\_rider.hh](#).

## 9.10 thermal\_params.cc File Reference

Thermal Parameter definition.

```
#include "../include/thermal_params.hh"
#include "utils/surface_model/include/interaction_surface.hh"
```

## Namespaces

- [jeod](#)  
*Namespace jeod.*

### 9.10.1 Detailed Description

Thermal Parameter definition.

Definition in file [thermal\\_params.cc](#).

## 9.11 thermal\_params.hh File Reference

A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys.

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

## Data Structures

- class [jeod::ThermalParams](#)  
*A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys.*

## Namespaces

- [jeod](#)

*Namespace jeod.*

### 9.11.1 Detailed Description

A virtual base class for thermal facet parameters, used to add to the parameter lists for specific-model facets in their respective InteractionSurfaceFactorys.

Definition in file [thermal\\_params.hh](#).

# Index

- ~ThermalFacetRider
  - jeod::ThermalFacetRider, [18](#)
- ~ThermalIntegrableObject
  - jeod::ThermalIntegrableObject, [23](#)
- ~ThermalModelRider
  - jeod::ThermalModelRider, [29](#)
- ~ThermalParams
  - jeod::ThermalParams, [31](#)
- accumulate\_thermal\_sources
  - jeod::ThermalFacetRider, [19](#)
- active
  - jeod::ThermalFacetRider, [20](#)
  - jeod::ThermalIntegrableObject, [26](#)
  - jeod::ThermalModelRider, [30](#)
- class\_declarations.hh, [33](#)
- compute\_temp\_dot
  - jeod::ThermalIntegrableObject, [24](#)
- create\_integrators
  - jeod::ThermalIntegrableObject, [24](#)
- cycle\_time
  - jeod::ThermalFacetRider, [20](#)
- d\_temperature
  - jeod::ThermalFacetRider, [20](#)
- destroy\_integrators
  - jeod::ThermalIntegrableObject, [24](#)
- dynamic\_temperature
  - jeod::ThermalFacetRider, [20](#)
- emissivity
  - jeod::ThermalFacetRider, [20](#)
  - jeod::ThermalParams, [31](#)
- facet
  - jeod::ThermalFacetRider, [20](#)
- get\_temp
  - jeod::ThermalIntegrableObject, [24](#)
- get\_temp\_dot
  - jeod::ThermalIntegrableObject, [24](#)
- heat\_capacity
  - jeod::ThermalFacetRider, [20](#)
- heat\_capacity\_per\_area
  - jeod::ThermalParams, [31](#)
- include\_internal\_thermal\_effects
  - jeod::ThermalModelRider, [30](#)
- incomplete\_setup\_error
  - jeod::ThermalMessages, [28](#)
- init\_attrjeod\_\_ThermalFacetRider
  - jeod::ThermalFacetRider, [19](#)
- init\_attrjeod\_\_ThermalIntegrableObject
  - jeod::ThermalIntegrableObject, [25](#)
- init\_attrjeod\_\_ThermalMessages
  - jeod::ThermalMessages, [27](#)
- init\_attrjeod\_\_ThermalModelRider
  - jeod::ThermalModelRider, [29](#)
- init\_attrjeod\_\_ThermalParams
  - jeod::ThermalParams, [31](#)
- initialize
  - jeod::ThermalFacetRider, [19](#)
  - jeod::ThermalIntegrableObject, [25](#)
- InputProcessor
  - jeod::ThermalFacetRider, [19](#)
  - jeod::ThermalIntegrableObject, [25](#)
  - jeod::ThermalMessages, [27](#)
  - jeod::ThermalModelRider, [29](#)
  - jeod::ThermalParams, [31](#)
- integrable\_object
  - jeod::ThermalFacetRider, [21](#)
- integrate
  - jeod::ThermalFacetRider, [19](#)
  - jeod::ThermalIntegrableObject, [25](#)
- integrator
  - jeod::ThermalIntegrableObject, [26](#)
- Interactions, [12](#)
- invalid\_integration\_operation
  - jeod::ThermalMessages, [28](#)
- jeod, [15](#)
- jeod::ThermalFacetRider, [17](#)
  - ~ThermalFacetRider, [18](#)
  - accumulate\_thermal\_sources, [19](#)
  - active, [20](#)
  - cycle\_time, [20](#)
  - d\_temperature, [20](#)
  - dynamic\_temperature, [20](#)
  - emissivity, [20](#)
  - facet, [20](#)
  - heat\_capacity, [20](#)
  - init\_attrjeod\_\_ThermalFacetRider, [19](#)
  - initialize, [19](#)
  - InputProcessor, [19](#)
  - integrable\_object, [21](#)
  - integrate, [19](#)
  - next\_temperature, [21](#)
  - operator=, [19](#)
  - power\_absorb, [21](#)

- power\_emit, 21
- rad\_constant, 21
- stefan\_boltzmann, 21
- thermal\_power\_dump, 22
- ThermalFacetRider, 18, 19
- jeod::ThermalIntegrableObject, 22
  - ~ThermalIntegrableObject, 23
  - active, 26
  - compute\_temp\_dot, 24
  - create\_integrators, 24
  - destroy\_integrators, 24
  - get\_temp, 24
  - get\_temp\_dot, 24
  - init\_attrjeod\_\_ThermalIntegrableObject, 25
  - initialize, 25
  - InputProcessor, 25
  - integrate, 25
  - integrator, 26
  - operator=, 25
  - reset\_integrators, 25
  - rider, 26
  - t\_pow4, 26
  - temp, 26
  - temp\_dot, 26
  - ThermalIntegrableObject, 23, 24
- jeod::ThermalMessages, 27
  - incomplete\_setup\_error, 28
  - init\_attrjeod\_\_ThermalMessages, 27
  - InputProcessor, 27
  - invalid\_integration\_operation, 28
  - operator=, 27
  - ThermalMessages, 27
- jeod::ThermalModelRider, 28
  - ~ThermalModelRider, 29
  - active, 30
  - include\_internal\_thermal\_effects, 30
  - init\_attrjeod\_\_ThermalModelRider, 29
  - InputProcessor, 29
  - operator=, 29
  - ThermalModelRider, 29
  - update, 29
- jeod::ThermalParams, 30
  - ~ThermalParams, 31
  - emissivity, 31
  - heat\_capacity\_per\_area, 31
  - init\_attrjeod\_\_ThermalParams, 31
  - InputProcessor, 31
  - operator=, 31
  - thermal\_power\_dump, 32
  - ThermalParams, 31
- Models, 11
- next\_temperature
  - jeod::ThermalFacetRider, 21
- operator=
  - jeod::ThermalFacetRider, 19
  - jeod::ThermalIntegrableObject, 25
  - jeod::ThermalMessages, 27
  - jeod::ThermalModelRider, 29
  - jeod::ThermalParams, 31
- PATH
  - ThermalRider, 13
- pow4
  - thermal\_facet\_rider.cc, 34
- power\_absorb
  - jeod::ThermalFacetRider, 21
- power\_emit
  - jeod::ThermalFacetRider, 21
- rad\_constant
  - jeod::ThermalFacetRider, 21
- reset\_integrators
  - jeod::ThermalIntegrableObject, 25
- rider
  - jeod::ThermalIntegrableObject, 26
- stefan\_boltzmann
  - jeod::ThermalFacetRider, 21
- t\_pow4
  - jeod::ThermalIntegrableObject, 26
- temp
  - jeod::ThermalIntegrableObject, 26
- temp\_dot
  - jeod::ThermalIntegrableObject, 26
- thermal\_facet\_rider.cc, 33
  - pow4, 34
- thermal\_facet\_rider.hh, 34
- thermal\_integrable\_object.cc, 34
- thermal\_integrable\_object.hh, 35
- thermal\_messages.cc, 35
- thermal\_messages.hh, 36
- thermal\_model\_rider.cc, 36
- thermal\_model\_rider.hh, 36
- thermal\_params.cc, 37
- thermal\_params.hh, 37
- thermal\_power\_dump
  - jeod::ThermalFacetRider, 22
  - jeod::ThermalParams, 32
- ThermalFacetRider
  - jeod::ThermalFacetRider, 18, 19
- ThermalIntegrableObject
  - jeod::ThermalIntegrableObject, 23, 24
- ThermalMessages
  - jeod::ThermalMessages, 27
- ThermalModelRider
  - jeod::ThermalModelRider, 29
- ThermalParams
  - jeod::ThermalParams, 31
- ThermalRider, 13
  - PATH, 13
- update
  - jeod::ThermalModelRider, 29