

ThermalModel

5.1

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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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| jeod | Namespace jeod | 15 |
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Chapter 3

Hierarchical Index

3.1 Class Hierarchy

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

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Chapter 4

Data Structure Index

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Here are the data structures with brief descriptions:

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| jeod::ThermalIntegrableObject | Encapsulates a thermal integrator for a facet | 24 |
| jeod::ThermalMessages | Specifying the message IDs used in the model | 31 |
| jeod::ThermalModelRider | Defining the thermal functionality | 34 |
| 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 | 37 |

Chapter 5

File Index

5.1 File List

Here is a list of all files with brief descriptions:

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| 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 | 45 |

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.

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 PATH

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

Definition at line 35 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](#) ()=default
- virtual [~ThermalFacetRider](#) ()=default
- [ThermalFacetRider](#) & [operator=](#) (const [ThermalFacetRider](#) &)=delete
- [ThermalFacetRider](#) (const [ThermalFacetRider](#) &)=delete
- void [initialize](#) (double temperature, double surface_area)
Initialize the thermal aspects of the facet.
- void [accumulate_thermal_sources](#) ()
Collects together all surface and internal thermal sources that affect a facet.
- double [integrate](#) ()
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](#) {true}

- *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 transfered 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 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 83 of file `thermal_facet_rider.hh`.

8.1.2 Constructor & Destructor Documentation

8.1.2.1 `ThermalFacetRider()` [1/2]

```
jeod::ThermalFacetRider::ThermalFacetRider ( ) [default]
```

8.1.2.2 ~ThermalFacetRider()

```
virtual jeod::ThermalFacetRider::~~ThermalFacetRider ( ) [virtual], [default]
```

8.1.2.3 ThermalFacetRider() [2/2]

```
jeod::ThermalFacetRider::ThermalFacetRider (
    const ThermalFacetRider & ) [delete]
```

8.1.3 Member Function Documentation

8.1.3.1 accumulate_thermal_sources()

```
void jeod::ThermalFacetRider::accumulate_thermal_sources ( )
```

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

Definition at line 60 of file thermal_facet_rider.cc.

References `power_absorb`, `power_emit`, and `thermal_power_dump`.

8.1.3.2 initialize()

```
void jeod::ThermalFacetRider::initialize (
    double temperature,
    double surface_area )
```

Initialize the thermal aspects of the facet.

Parameters

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

Definition at line 108 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 integrate()

```
double jeod::ThermalFacetRider::integrate ( )
```

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

Returns

void

Definition at line 160 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 operator=()

```
ThermalFacetRider& jeod::ThermalFacetRider::operator= (
    const ThermalFacetRider & ) [delete]
```

8.1.4 Friends And Related Function Documentation

8.1.4.1 init_attrjeod__ThermalFacetRider

```
void init_attrjeod__ThermalFacetRider ( ) [friend]
```

8.1.4.2 InputProcessor

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

Definition at line 85 of file thermal_facet_rider.hh.

8.1.5 Field Documentation

8.1.5.1 active

```
bool jeod::ThermalFacetRider::active {true}
```

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

trick_units(-)

Definition at line 134 of file thermal_facet_rider.hh.

Referenced by integrate().

8.1.5.2 cycle_time

```
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 91 of file thermal_facet_rider.hh.

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

8.1.5.3 d_temperature

```
double jeod::ThermalFacetRider::d_temperature {}
```

Change in temperature.

trick_units(-)

Definition at line 96 of file thermal_facet_rider.hh.

Referenced by integrate().

8.1.5.4 dynamic_temperature

```
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 175 of file thermal_facet_rider.hh.

Referenced by initialize(), and integrate().

8.1.5.5 emissivity

```
double jeod::ThermalFacetRider::emissivity {}
```

Fraction of σT^4 (potential for emissive radiation) that is actually emitted.

trick_units(-)

Definition at line 148 of file thermal_facet_rider.hh.

Referenced by initialize().

8.1.5.6 facet

```
InteractionFacet* jeod::ThermalFacetRider::facet {}
```

Pointer back to facet that contains this thermal rider.

trick_units(-)

Definition at line 127 of file thermal_facet_rider.hh.

8.1.5.7 heat_capacity

```
double jeod::ThermalFacetRider::heat_capacity {}
```

Heat capacity of the facet.

trick_units(-)

Definition at line 115 of file thermal_facet_rider.hh.

Referenced by jeod::ThermalIntegrableObject::compute_temp_dot(), and integrate().

8.1.5.8 integrable_object

```
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 154 of file thermal_facet_rider.hh.

Referenced by initialize().

8.1.5.9 next_temperature

```
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 169 of file thermal_facet_rider.hh.

Referenced by initialize(), and integrate().

8.1.5.10 power_absorb

```
double jeod::ThermalFacetRider::power_absorb {}
```

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

trick_units(-)

Definition at line 102 of file thermal_facet_rider.hh.

Referenced by accumulate_thermal_sources(), jeod::ThermalIntegrableObject::compute_temp_dot(), jeod::↵
ThermalIntegrableObject::integrate(), and integrate().

8.1.5.11 power_emit

```
double jeod::ThermalFacetRider::power_emit {}
```

Rate at which energy is thermally radiated from the facet.

trick_units(-)

Definition at line 107 of file thermal_facet_rider.hh.

Referenced by accumulate_thermal_sources(), jeod::ThermalIntegrableObject::compute_temp_dot(), and inte-
grate().

8.1.5.12 rad_constant

```
double jeod::ThermalFacetRider::rad_constant {}
```

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

trick_units(-)

Definition at line 122 of file thermal_facet_rider.hh.

Referenced by jeod::ThermalIntegrableObject::compute_temp_dot(), initialize(), jeod::ThermalIntegrableObject↵
::integrate(), and integrate().

8.1.5.13 stefan_boltzmann

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

Stefan-Boltzmann constant.

trick_io(*o) trick_units(-)

Definition at line 161 of file thermal_facet_rider.hh.

Referenced by initialize().

8.1.5.14 thermal_power_dump

```
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 140 of file thermal_facet_rider.hh.

Referenced by accumulate_thermal_sources().

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

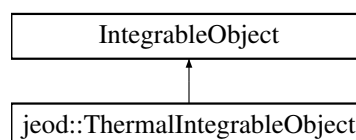
- [thermal_facet_rider.hh](#)
- [thermal_facet_rider.cc](#)

8.2 jeod::ThermalIntegrableObject Class Reference

Encapsulates a thermal integrator for a facet.

```
#include <thermal_integrable_object.hh>
```

Inheritance diagram for jeod::ThermalIntegrableObject:



Public Member Functions

- [ThermalIntegrableObject](#) ()
ThermalIntegrableObject default constructor.
- [~ThermalIntegrableObject](#) () override
ThermalIntegrableObject destructor.
- [ThermalIntegrableObject & operator=](#) (const [ThermalIntegrableObject](#) &)=delete
- [ThermalIntegrableObject](#) (const [ThermalIntegrableObject](#) &)=delete
- void [initialize](#) (double temperature, [ThermalFacetRider](#) &associated_rider)
Initialize temperature and cache a pointer to the ThermalFacetRider.
- void [create_integrators](#) (const er7_utils::IntegratorConstructor &generator, er7_utils::IntegrationControls &controls, const er7_utils::TimeInterface &time_if) override
Create the first order integrator for this IntegrableObject.
- void [destroy_integrators](#) () override
Destroy integrators for this IntegrableObject.
- void [reset_integrators](#) () override
Reset the integrator.
- er7_utils::IntegratorResult [integrate](#) (double dyn_dt, unsigned int target_stage) override
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 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 87 of file thermal_integrable_object.hh.

8.2.2 Constructor & Destructor Documentation

8.2.2.1 ThermalIntegrableObject() [1/2]

```
jeod::ThermalIntegrableObject::ThermalIntegrableObject ( )
```

[ThermalIntegrableObject](#) default constructor.

Definition at line 47 of file thermal_integrable_object.cc.

References [integrator](#).

8.2.2.2 ~ThermalIntegrableObject()

```
jeod::ThermalIntegrableObject::~~ThermalIntegrableObject ( ) [override]
```

[ThermalIntegrableObject](#) destructor.

Definition at line 56 of file thermal_integrable_object.cc.

References [destroy_integrators\(\)](#), and [integrator](#).

8.2.2.3 ThermalIntegrableObject() [2/2]

```
jeod::ThermalIntegrableObject::ThermalIntegrableObject (
    const ThermalIntegrableObject & ) [delete]
```

8.2.3 Member Function Documentation

8.2.3.1 compute_temp_dot()

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

Compute emitted power and the time derivative of temperature.

Definition at line 142 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 create_integrators()

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

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 68 of file thermal_integrable_object.cc.

References integrator.

8.2.3.3 destroy_integrators()

```
void jeod::ThermalIntegrableObject::destroy_integrators ( ) [override]
```

Destroy integrators for this IntegrableObject.

Definition at line 78 of file thermal_integrable_object.cc.

Referenced by ~ThermalIntegrableObject().

8.2.3.4 `get_temp()`

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

Get the temperature.

Returns

Facet temperature.

Definition at line 121 of file `thermal_integrable_object.hh`.

8.2.3.5 `get_temp_dot()`

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

Get the temperature time derivative.

Returns

Facet temperature time derivative.

Definition at line 130 of file `thermal_integrable_object.hh`.

8.2.3.6 `initialize()`

```
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 ThermalFacetRider |

Definition at line 131 of file `thermal_integrable_object.cc`.

References `rider`, `t_pow4`, and `temp`.

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

8.2.3.7 integrate()

```
er7_utils::IntegratorResult jeod::ThermalIntegrableObject::integrate (
    double dyn_dt,
    unsigned int target_stage ) [override]
```

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 98 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 operator=()

```
ThermalIntegrableObject& jeod::ThermalIntegrableObject::operator= (
    const ThermalIntegrableObject & ) [delete]
```

8.2.3.9 reset_integrators()

```
void jeod::ThermalIntegrableObject::reset_integrators ( ) [override]
```

Reset the integrator.

Definition at line 86 of file thermal_integrable_object.cc.

References `integrator`.

8.2.4 Friends And Related Function Documentation

8.2.4.1 init_attrjeod__ThermalIntegrableObject

```
void init_attrjeod__ThermalIntegrableObject ( ) [friend]
```

8.2.4.2 InputProcessor

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

Definition at line 89 of file thermal_integrable_object.hh.

8.2.5 Field Documentation

8.2.5.1 active

```
bool jeod::ThermalIntegrableObject::active {}
```

If true, this IntegrableObject will integrate temperature.

trick_units(-)

Definition at line 140 of file thermal_integrable_object.hh.

8.2.5.2 integrator

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

Integrates temperature on one facet.

trick_units(-)

Definition at line 147 of file thermal_integrable_object.hh.

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

8.2.5.3 rider

```
ThermalFacetRider* jeod::ThermalIntegrableObject::rider {} [private]
```

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

trick_units(-)

Definition at line 152 of file thermal_integrable_object.hh.

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

8.2.5.4 t_pow4

```
double jeod::ThermalIntegrableObject::t_pow4 {} [private]
```

Fourth power of current temperature.

trick_units(K*K*K*K)

Definition at line 167 of file thermal_integrable_object.hh.

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

8.2.5.5 temp

```
double jeod::ThermalIntegrableObject::temp {} [private]
```

Temperature of the facet.

trick_units(K)

Definition at line 157 of file thermal_integrable_object.hh.

Referenced by initialize(), and integrate().

8.2.5.6 temp_dot

```
double jeod::ThermalIntegrableObject::temp_dot {} [private]
```

Time derivative of temperature.

trick_units(K/s)

Definition at line 162 of file thermal_integrable_object.hh.

Referenced by compute_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>
```

Public Member Functions

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

Static Public Attributes

- static const char * [incomplete_setup_error](#) = "utils/thermal_rider/" "incomplete_setup_error"
Generic error; the model was not set up correctly.
- static const char * [invalid_integration_operation](#) = "utils/thermal_rider/" "invalid_integration_operation"
The integration is invalid, usually because the integration step is too large.

Friends

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

8.3.1 Detailed Description

Specifying the message IDs used in the model.

Definition at line 79 of file thermal_messages.hh.

8.3.2 Constructor & Destructor Documentation

8.3.2.1 ThermalMessages() [1/2]

```
jeod::ThermalMessages::ThermalMessages ( ) [delete]
```

8.3.2.2 ThermalMessages() [2/2]

```
jeod::ThermalMessages::ThermalMessages (
    const ThermalMessages & ) [delete]
```

8.3.3 Member Function Documentation

8.3.3.1 operator=()

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

8.3.4 Friends And Related Function Documentation

8.3.4.1 init_attrjeod__ThermalMessages

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

8.3.4.2 InputProcessor

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

Definition at line 81 of file thermal_messages.hh.

8.3.5 Field Documentation

8.3.5.1 incomplete_setup_error

```
const char * jeod::ThermalMessages::incomplete_setup_error = "utils/thermal_rider/" "incomplete↵
_setup_error" [static]
```

Generic error; the model was not set up correctly.

trick_units(-)

Definition at line 87 of file thermal_messages.hh.

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

8.3.5.2 invalid_integration_operation

```
const char * jeod::ThermalMessages::invalid_integration_operation = "utils/thermal_rider/"
"invalid_integration_operation" [static]
```

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

trick_units(-)

Definition at line 93 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](#) ()=default
- virtual [~ThermalModelRider](#) ()=default
- [ThermalModelRider](#) & [operator=](#) (const [ThermalModelRider](#) &)=delete
- [ThermalModelRider](#) (const [ThermalModelRider](#) &)=delete
- 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.

Friends

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

8.4.1 Detailed Description

Defining the thermal functionality.

Definition at line 82 of file thermal_model_rider.hh.

8.4.2 Constructor & Destructor Documentation

8.4.2.1 ThermalModelRider() [1/2]

```
jeod::ThermalModelRider::ThermalModelRider ( ) [default]
```

8.4.2.2 ~ThermalModelRider()

```
virtual jeod::ThermalModelRider::~~ThermalModelRider ( ) [virtual], [default]
```

8.4.2.3 ThermalModelRider() [2/2]

```
jeod::ThermalModelRider::ThermalModelRider (
    const ThermalModelRider & ) [delete]
```

8.4.3 Member Function Documentation

8.4.3.1 operator=()

```
ThermalModelRider& jeod::ThermalModelRider::operator= (
    const ThermalModelRider & ) [delete]
```

8.4.3.2 update()

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

update the thermal aspects of all facets

Parameters

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

Definition at line 52 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 init_attrjeod__ThermalModelRider

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

8.4.4.2 InputProcessor

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

Definition at line 84 of file thermal_model_rider.hh.

8.4.5 Field Documentation

8.4.5.1 active

```
bool jeod::ThermalModelRider::active {}
```

Flag to allow thermal variation of facets.

trick_units(—)

Definition at line 88 of file thermal_model_rider.hh.

Referenced by update().

8.4.5.2 include_internal_thermal_effects

```
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 94 of file thermal_model_rider.hh.

Referenced by 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 InteractionSurfaceFactorys.

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

Public Member Functions

- [ThermalParams](#) ()=default
- virtual [~ThermalParams](#) ()=default
- [ThermalParams](#) & [operator=](#) (const [ThermalParams](#) &)=delete
- [ThermalParams](#) (const [ThermalParams](#) &)=delete

Data Fields

- double [emissivity](#) {}
Fraction of $\sigma \cdot T^4$ (potential for emissive thermal) that is actually emitted.
- double [heat_capacity_per_area](#) {1.0E+20}
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.

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 80 of file thermal_params.hh.

8.5.2 Constructor & Destructor Documentation

8.5.2.1 ThermalParams() [1/2]

```
jeod::ThermalParams::ThermalParams ( ) [default]
```

8.5.2.2 ~ThermalParams()

```
virtual jeod::ThermalParams::~~ThermalParams ( ) [virtual], [default]
```

8.5.2.3 ThermalParams() [2/2]

```
jeod::ThermalParams::ThermalParams (
    const ThermalParams & ) [delete]
```

8.5.3 Member Function Documentation

8.5.3.1 operator=()

```
ThermalParams& jeod::ThermalParams::operator= (
    const ThermalParams & ) [delete]
```

8.5.4 Friends And Related Function Documentation

8.5.4.1 init_attrjeod__ThermalParams

```
void init_attrjeod__ThermalParams ( ) [friend]
```

8.5.4.2 InputProcessor

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

Definition at line 82 of file thermal_params.hh.

8.5.5 Field Documentation

8.5.5.1 emissivity

```
double jeod::ThermalParams::emissivity {}
```

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

trick_units(—)

Definition at line 87 of file thermal_params.hh.

8.5.5.2 heat_capacity_per_area

```
double jeod::ThermalParams::heat_capacity_per_area {1.0E+20}
```

Heat Capacity per unit area of surface.

trick_units(—)

Definition at line 92 of file thermal_params.hh.

8.5.5.3 thermal_power_dump

```
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 99 of file thermal_params.hh.

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

- [thermal_params.hh](#)

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.

9.2 thermal_facet_rider.cc File Reference

ThermalFacetRider interaction model.

```
#include <cmath>
#include <cstdint>
#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.

9.2.2 Macro Definition Documentation

9.2.2.1 pow4

```
#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.

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.

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.

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.

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.

9.8 thermal_model_rider.cc File Reference

ThermalModelRider interaction model.

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

Namespaces

- [jeod](#)
Namespace jeod.

9.8.1 Detailed Description

ThermalModelRider interaction model.

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.

9.10 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.

9.10.1 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.

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