

PRETREF-OPENFOAM REPOSITORY

GEORGIOS MARAGKOS

DEPARTMENT STRUCTURAL ENGINEERING – GHENT UNIVERSITY, BELGIUM

PRETREF PROJECT WORKSHOP

16 OCTOBER 2019, GHENT - BELGIUM



OUTLINE

- ✓ About the repository
- ✓ Repository feedback
- ✓ People involved



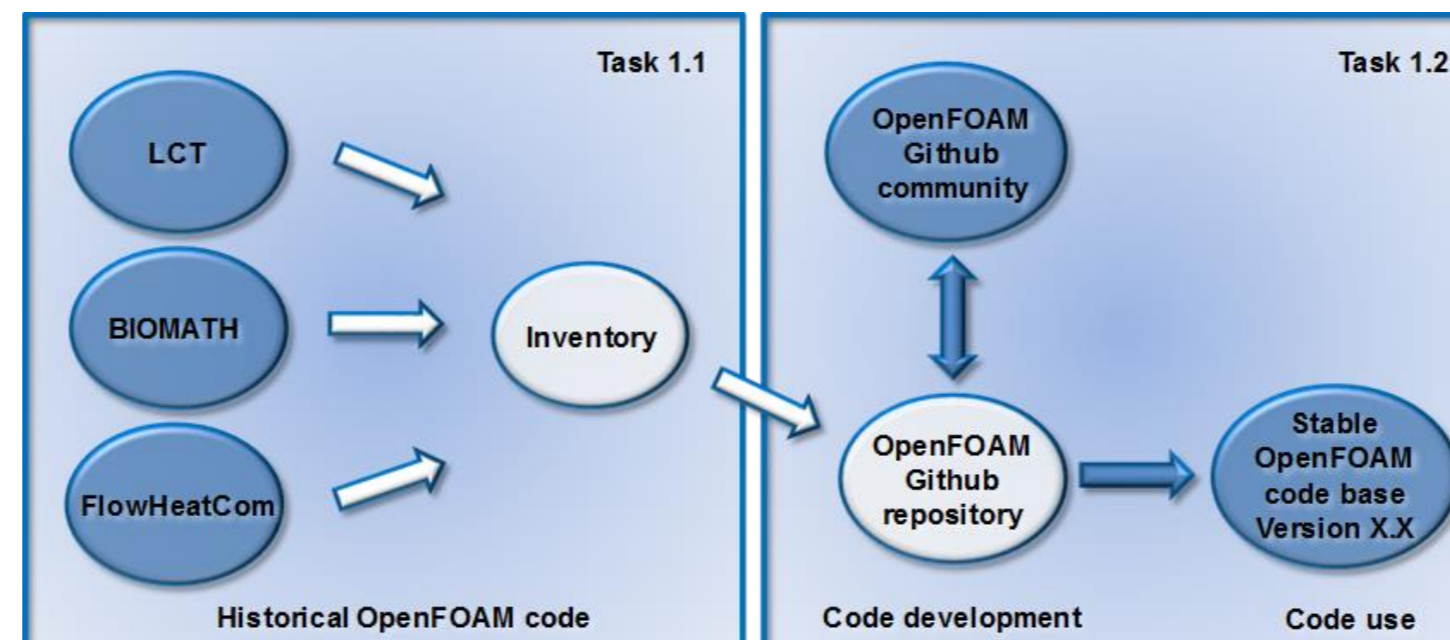
ABOUT THE REPOSITORY



PRETREF - OpenFOAM repository - <https://github.ugent.be/gmaragko/pretref>

A Computational Fluid Dynamics (CFD) code-base for Large Eddy Simulations (LES) applicable multiscale modelling of several multidisciplinary applications.

- ✓ Free and easily accessible by the UGent community
- ✓ Open-source - based on the OpenFOAM platform
- ✓ Code sharing and joint code development - based on GitHub
- ✓ Properly documented - wiki page



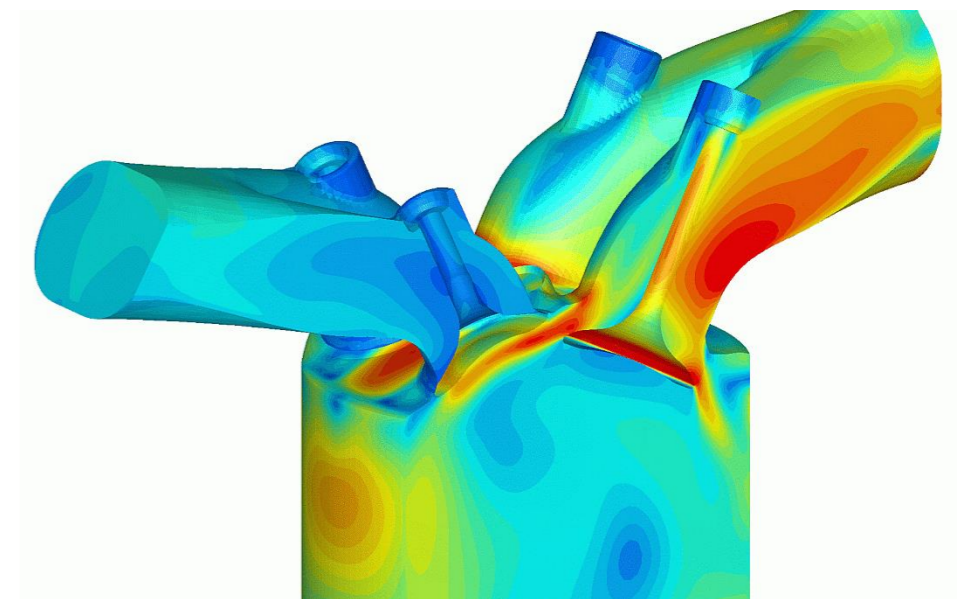
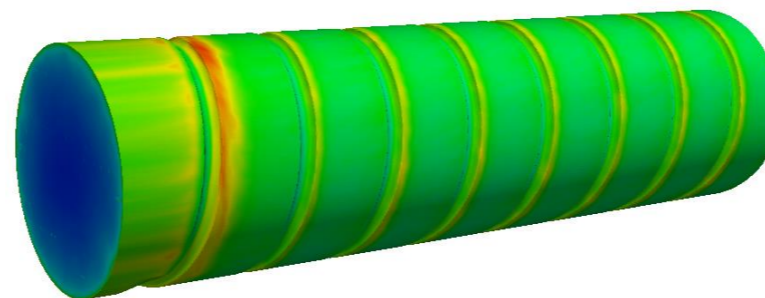
ABOUT THE REPOSITORY



PRETREF - OpenFOAM repository - <https://github.ugent.be/gmaragko/pretref>

Goal of the repository

- ✓ Enhance collaboration between different research groups, faculties, and scientific domains within UGent.
- ✓ Contribute to a more reproducible, peer reviewed way of research.
- ✓ Decrease the steep learning curve for new researcher working with OpenFOAM
 - Code documentation (in .H files of the models)
 - Wiki page (<https://github.ugent.be/gmaragko/pretref/wiki>)
 - Pre-set tutorials for a wide range of applications
 - References to relevant publications



ABOUT THE REPOSITORY



PRETREF - OpenFOAM repository - <https://github.ugent.be/gmaragko/pretref>

OpenFOAM version of the repository

- ✓ Most materials are based on OpenFOAM 2.2.x.
- ✓ Check the other branches for material of newer OpenFOAM versions.

Contents of the repository

- ✓ pretref-2.2.x: OpenFOAM material which compiles with OpenFOAM-2.2.x
 - applications (solvers, pre-processing utilities)
 - src (meshing tools, thermophysical models, turbulence models, wall functions)
 - tutorials (ready to run tutorial cases)
- ✓ wiki page: <https://github.ugent.be/gmaragko/pretref/wiki>

ABOUT THE REPOSITORY



Branch: master ▾ pretref / pretref-2.2.x / Create new file Upload files Find file History

gmaragko Update README	Latest commit 4e9ef81 4 minutes ago
..	
applications	Updates 2 days ago
src	Delete alphaSgsConvectiveWallFunctionFvPatchScalarField.C 2 days ago
tutorials	Updates 2 days ago
Allwclean	Updates 2 days ago
Allwmake	Updates 2 days ago
README	Update README 4 minutes ago

README

```
The libraries are known to compile with OpenFOAM 2.2.x available from https://github.com/OpenFOAM/OpenFOAM-2.2.x.

The combustion/fireFoam tutorials run with fireFoam 2.2.x available from https://github.com/fireFoam-dev/fireFoam-2.2.x. Some
tutorials might require swak4Foam for setting up (https://openfoamwiki.net/index.php/Contrib/swak4Foam).

First run ./Allwclean to clean any pre-compiled libraries.
Simply run ./Allwmake to install the repository.

Information regarding the models are included in the .H files. Check the wiki page for additional information of the included
material (https://github.ugent.be/gmaragko/pretref/wiki).

!!!!!!!!!!!!!!!!!!!!!! Commands !!!!!!!!!!!!!!!!!!!!!!!
To give permission to scripts:
find . -name "Allwclean" -exec chmod +x {} \;
find . -name "Allwmake" -exec chmod +x {} \;
find . -name "pre" -exec chmod +x {} \;
find . -name "clean" -exec chmod +x {} \;
find . -name "dec" -exec chmod +x {} \;

To delete any ~ files within the repository:
find . -type f -name '*~' -delete
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Disclaimer
-----
This offering is not approved or endorsed by OpenCFD Limited, the producer
of the OpenFOAM software and owner of the OPENFOAM® and OpenCFD® trade marks.
```

ABOUT THE REPOSITORY



gmaragko / pretref Private Unwatch 12 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Branch: master pretref / pretref-2.2.x / tutorials / combustion / fireFoam / Create new file Upload files Find file History

gmaragko Updates Latest commit d9dcc3c 2 days ago

..		
1DPyrolysis	Updates	2 days ago
McCaffrey	Updates	2 days ago
compartmentFire	Updates	2 days ago
dropletEvaporation	Updates	2 days ago
firePlume	Updates	2 days ago
flameSpread_corner	Updates	2 days ago
flameSpread_parallelPanels	Updates	2 days ago
flame_extinction	Updates	2 days ago
heliumPlume	Updates	2 days ago
sprayPlumeInteraction	Updates	2 days ago
thermalPlume	Updates	2 days ago
tunnelFire	Updates	2 days ago

ABOUT THE REPOSITORY



Branch: master ▾ pretref / pretref-2.2.x / src / mesh / extrudeModel /

Create new file Upload files Find file History

gmaragko Updates Latest commit d9dcc3c 2 days ago

..		
Make	Updates	2 days ago
dimplesRadial	Updates	2 days ago
finnedRadial	Updates	2 days ago
helicallyFinnedRadial	Updates	2 days ago
helicoidal	Updates	2 days ago
InInclude	Updates	2 days ago
mertRadial	Updates	2 days ago
movingDimplesRadial	Updates	2 days ago
movingFinned	Updates	2 days ago
movingFinnedRadial	Updates	2 days ago
movingHelicallyFinnedRadial	Updates	2 days ago
movingMertRadial	Updates	2 days ago
movingRadialToCylinder	Updates	2 days ago
movingSinusRibRadial	Updates	2 days ago
movingSlitMertRadial	Updates	2 days ago
radialToCylinder	Updates	2 days ago
sinusRibRadial	Updates	2 days ago
slitMertRadial	Updates	2 days ago
uniformRadial	Updates	2 days ago
.DS_Store	Updates	2 days ago

ABOUT THE REPOSITORY



gmaragko / pretref Private Unwatch 12 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Branch: master pretref / pretref-2.2.x / applications / solvers / reactive / Create new file Upload files Find file History

gmaragko Updates Latest commit d9dcc3c 2 days ago

..

chtQSSAFoam	Updates	2 days ago
periodicReactingFoam	Updates	2 days ago
.DS_Store	Updates	2 days ago

gmaragko / pretref Private Unwatch 12 Star 0 Fork 0

Code Issues 0 Pull requests 0 Projects 0 Wiki Insights Settings

Branch: master pretref / pretref-2.2.x / src / thermophysicalModels / combustionModels / Create new file Upload files Find file History

gmaragko Delete EDM.H Latest commit eF730F2 2 days ago

..

EDC	Updates	2 days ago
EDCExtinction	Updates	2 days ago
EDMExtinction	Updates	2 days ago
Make	Updates	2 days ago
dynamicEDC	Updates	2 days ago
myEDM	Updates	2 days ago

ABOUT THE REPOSITORY



gmaragko edited this page a day ago · 75 revisions

Code

Models

gmaragko edi

Combustion

- myEDM:** Eddy Dissipation Model with a reaction time scale for under-resolved fire dynamics based on [1]. The fuel reaction rate is calculated as:

$$\overline{\dot{\omega}}_F''' = \bar{\rho} \frac{\min(\tilde{Y}_F, \tilde{Y}_{O_2}/s)}{\tau_{mix}}$$

Welcome to
This is the re
University (U

where the mixing time scale τ_{mix} is calculated by taking the minimum between the mixing time scales for diffusion (Δ^2/D_F), sub-grid scale advection ($0.4\Delta/((2/3)k_{sgs})^{0.5}$) and buoyant acceleration ($\sqrt{(2\Delta/g)}$).

To use the model:

```
combustionModel myEDM<psiThermoCombustion,gasHThermoPhysics>;  
  
myEDMCoeffs  
{  
    semiImplicit no;  
}
```

- EDC:** Eddy Dissipation Concept based on [2] and [3]. The fuel reaction rate is calculated as:

$$\overline{\dot{\omega}}_F''' = \bar{\rho} \frac{\gamma^2 \chi}{\tau(1 - \gamma^3 \chi)} \min\left(\tilde{Y}_F, \frac{\tilde{Y}_{O_2}}{s}\right)$$

The size of the fine structures can be expressed as:

$$\gamma = C_\gamma \left(\frac{\nu \epsilon_{sgs}}{k_{sgs}^2}\right)^{1/4}$$

Pages 5

Find a Page...

- Home
- Models
- Solvers
- Tutorials
- Utilities

+ Add a custom sidebar

Clone this wiki locally

https://github.ugent.be/gi

Fork 0

New Page

idebar

be/gi



ABOUT THE REPOSITORY



- **dynamicSmagorinsky**: The dynamic Smagorinsky model for compressible flows [9]. The sub-grid scale dynamic viscosity is calculated as:

$$\mu_{sgs} = \bar{\rho}(c_s\Delta)^2|\tilde{S}|$$

where

$$c_s^2 = \frac{0.5\langle L_{ij} M_{ij} \rangle}{\langle M_{ij} M_{ij} \rangle}$$

$$\text{with } L_{ij} = \widehat{\overline{\rho u_i u_j}} - (\widehat{\overline{\rho u_i}} \widehat{\overline{\rho u_j}}) / \widehat{\rho},$$

$$\beta_{ij} = -\widehat{\Delta^2 \rho} |\tilde{S}| (\tilde{S}_{ij} - \delta_{ij} \tilde{S}_{kk} / 3), \alpha_{ij} = -\Delta^2 \bar{\rho} |\tilde{S}| (\tilde{S}_{ij} - \delta_{ij} \tilde{S}_{kk} / 3) \text{ and } M_{ij} = \beta_{ij} - \widehat{\alpha_{ij}}. \text{ The hat}$$

denotes the application of a test filter of characteristic width $\widehat{\Delta} = \sqrt{6}\Delta$ while $\check{f} = \widehat{\rho f} / \widehat{\rho}$.

The sub-grid kinetic energy is estimated as:

$$k_{sgs} = c_I \Delta^2 |\tilde{S}|^2$$

where

$$c_I = \langle 0.5 L_{kk} M_{kk} \rangle / \langle M_{kk} M_{kk} \rangle$$

$$\text{with } L_{kk} = \widehat{\overline{\rho u_k u_k}} - \widehat{\overline{\rho u_k}} \widehat{\overline{\rho u_k}} / \widehat{\rho}, M_{kk} = \widehat{\Delta^2 \rho} |\tilde{S}|^2 - \widehat{\Delta^2 \rho} |\tilde{S}|^2 \text{ and } \check{f} = \widehat{\rho f} / \widehat{\rho}.$$

To use the model:

```
LESModel      dynamicSmagorinsky;

dynamicSmagorinskyCoeffs
{
    filter      simple;
    Prt         0.5;
}
```

Combustion

fireFoam

Tutorial cases run with fireFOAM version 2.2.x available from <https://github.com/fireFoam-dev/fireFoam-2.2.x> and OF-2.2.x available from <https://github.com/OpenFOAM/OpenFOAM-2.2.x>. Some combustion tutorials might require swak4Foam for setting up. <https://openfoamwiki.net/index.php/Contrib/swak4Foam>

- **firePlume**: Sandia's 1m CH4 fire plume case (2.61 MW) [1-3].
- **compartmentFire**: Steckler's compartment fire case (experiment 18) [4].
- **flameSpread_parallelPanels**: FM Global's parallel panel case [5].
- **flameSpread_corner**: Example of a Single Burning Item (SBI) case [6-9].
- **1DPyrolysis** (simple 1D pyrolysis example): -
- **heliumPlume**: Sandia's 1m helium plume case [10-13].
- **tunnelFire**: Fictitious fire in a tunnel-line geometry example.
- **thermalPlume**: The thermal plume case of Shabbir and George [14].
- **McCaffrey**: The 14.4k W case from McCaffrey's experiments [15].
- **sprayPlumeInteraction**: Case involving interaction of thermal plume with a water spray [16-19].
- **dropletEvaporation**: Two cases involving evaporation of single water droplets [20-21].

ABOUT THE REPOSITORY



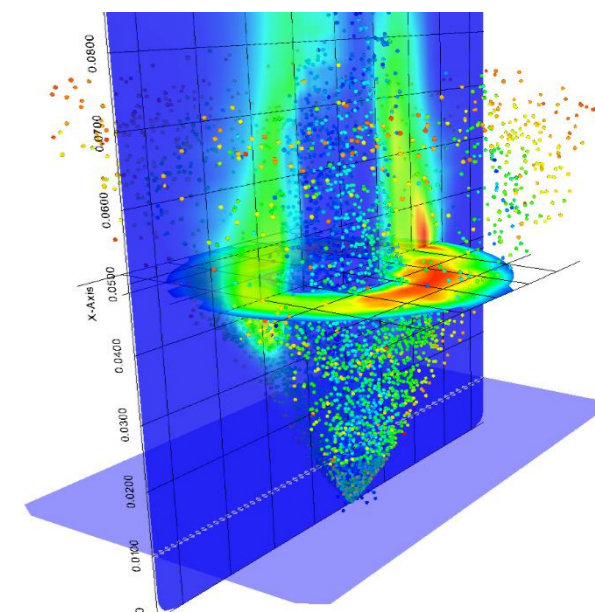
PRETREF - OpenFOAM repository - <https://github.ugent.be/gmaragko/pretref>

Pre-requisites for installing the repository

- ✓ OpenFOAM-2.2.x from <https://github.com/OpenFOAM/OpenFOAM-2.2.x>
- ✓ fireFoam-2.2.x from <https://github.com/fireFoam-dev> (for any fire-related applications)
- ✓ swak4Foam from <https://openfoamwiki.net/index.php/Contrib/swak4Foam> (for setting up some of the tutorials)

Installation of the repository

- ✓ Run the ./Allwclean script to clean any pre-compiled libraries.
- ✓ Run the ./Allwmake script to install the repository.



REPOSITORY FEEDBACK

PRETREF - OpenFOAM repository - <https://github.ugent.be/gmaragko/pretref>

- ✓ Contributions to the repository are welcome – become a collaborator!
- ✓ Feedback to the repository (e.g., suggestions, bugs, etc.) through the GitHub repository directly or at Georgios.Maragkos@Ugent.be

www.pretref.ugent.be



PEOPLE INVOLVED



People involved within the PRETREF project:

- Alessandro D'Ausilio (PhD candidate)
- Gilles Decan (PhD candidate)
- Jens Dedeyne (PhD candidate)
- David Fernandes del Pozo (PhD candidate)
- Boris Kruljevic (PhD candidate)
- Haohan Li (PhD candidate)
- Sepehr Madanikashani (PhD candidate)
- Noel Gómez Mendoza (PhD candidate)
- Laurien Vandewalle (PhD candidate)
- Pieter Reyniers (Dr.)
- David Van Cauwenberge (Dr.)
- Florian Vandecasteele (Dr.)
- Tarek Beji (Postdoc)
- Georgios Maragkos (Postdoc)
- Ivana Stankovic (Postdoc)
- Bart Merci (Prof.)
- Ingmar Nopens (Prof.)
- Kevin Van Geem (Prof.)
- Sebastian Verhelst (Prof.)
- Steven Verstockt (Prof.)
- Jan Vierendeels (Prof.)



Thanks to all the collaborators!

THE END

A project funded by **Ghent University** through GOA project BOF16/GOA/004.

Thank you for your attention!
Questions ?

www.pretref.ugent.be

