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Air flow in the urban area of Hsinchu city

REPORT FROM THE STUDENT INTERNSHIP

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Summary

Abstract of the report will be there

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NCHC servers use Singularity container platform [**singularity**] and Slurm workload manager [**slurm**] to run user-defined tasks. Thus,

(i) custom singularity container, which includes necessary applications and packages installed inside, is prepared, and

(ii) slurm task (which works within the container) is prepared and run at the computational server.

3.1 Preparation of the singularity container

Assuming you have super-user permission and singularity installed, a preparation of the singularity container image from docker ubuntu:latest release and with openfoam.org/v10 and other useful applications installed inside can be done as follows:

- Navigate outside the home directory, e.g. `/tmp/test/` and work here.
- New container (`./ubuntu`) is created from ubuntu docker repository, `--sandbox` flag allows to write into it later:

  ```
  sudo singularity build --sandbox ./ubuntu docker://ubuntu:latest
  ```
- Shell inside container is opened with `--writable` flag to install necessary stuff into container:

  ```
  sudo singularity shell ./ubuntu --writable
  ```
- Installation of the basic applications and openfoam.org/v10 into container:

  ```
  apt update
  apt install python3 python3-pip wget vim software-properties-common
      python3-tk
  pip3 install matplotlib
  sh -c "wget -O - https://dl.openfoam.org/gpg.key >
      /etc/apt/trusted.gpg.d/openfoam.asc"
  add-apt-repository http://dl.openfoam.org/ubuntu
  apt update
  apt install openfoam10
  ```
- If you want to compile custom openfoam solver, source openfoam in container:

  ```
  .  /opt/openfoam10/etc/bashrc
  ```
- and compile it using `wmake` in prepared solver directory (in our case in `./01_codes/OF_cases/03_customSolvers/pollutionFoam`).

- When everything is installed, the `.sif` container file can be build using:

  `sudo singularity build ubuntu.sif ./ubuntu/`

Following the above listed guideline, singularity container image `ubuntu.sif` is created. This can be uploaded to NCHC servers and used as described in following subsection.

3.2 Preparation of slurm control script and running of task

4 Numerical experiments

Some nice results her.

5 Conclusions

And conclusion here

6 Nomenclature

c_i	....	Molar concentration of i-th molar specie
c_T	....	Total molar concentration
Co	....	Courant number
d	....	Diameter
D_i	....	Molar diffusivity of i-th molar specie
D_i^eff	....	Effective molar diffusivity of i-th molar specie
$\boldsymbol{d}_\mathrm{PN}$	....	Vector connecting centroids of P and N
f	....	Face of the cell
$\boldsymbol{f}_b$	....	Body forces acting on cell
$\boldsymbol{g}$	....	Gravitational acceleration
h	....	Specific enthalpy
I	....	Time interval
I^h	....	Discretized time interval
m	....	Number of discretized FV cells
M	....	Molar mass
n	....	Number of species
$\boldsymbol{n}$	....	Outer normal vector
$\boldsymbol{n}_f$	....	Outer normal vector of the face f
p	....	Pressure
p_ref	....	Reference pressure
$\tilde{p}$	....	Kinematic pressure
Q	....	Computational domain
r_i	....	Reaction source of the i-th molar specie
R^g	....	Universal gas constant
Re	....	Reynolds number
s_ϕ	....	Source of the ϕ
$\boldsymbol{S}_f$	....	Face area vector
t	....	Time
T	....	Temperature
T_ref	....	Reference temperature
$\boldsymbol{u} = (u, v, w)$	....	Velocity
y_i	....	Molar fraction of the i-molar specie
α	....	Heat transfer coefficient
ε	....	Porosity
Γ_ϕ	....	Diffusivity of ϕ
κ	....	Permeability
λ	....	Heat conductivity
μ	....	Dynamic viscosity
ν	....	Kinematic viscosity
Ω	....	Domain
Ω^h	....	Discretized domain
Ω_P^h	....	Cell P
$\delta\Omega_i^h$	....	Volume of the cell
$\partial\Omega$	....	Domain boundary
ϕ	....	Intensive tensorial quantity
ϕ_P	....	Value of ϕ in the cell centroid of cell P

ϕ_f	....	Value of ϕ in the face centroid of face f
$\mathbf{\Phi}_\phi$	....	Flux intensity of ϕ
$\mathbf{\Phi}_{\phi,\mathrm{conv}}$	....	Convective flux intensity of ϕ
$\mathbf{\Phi}_{\phi,\mathrm{diff}}$	....	Diffusive flux intensity of ϕ
ρ	....	Fluid mass density
Σ	....	Total stress tensor
τ	....	Tortuosity
$\boldsymbol{\tau}$	....	Viscous stress tensor
∇	....	Nabla differential operator

Potencial appendix here.