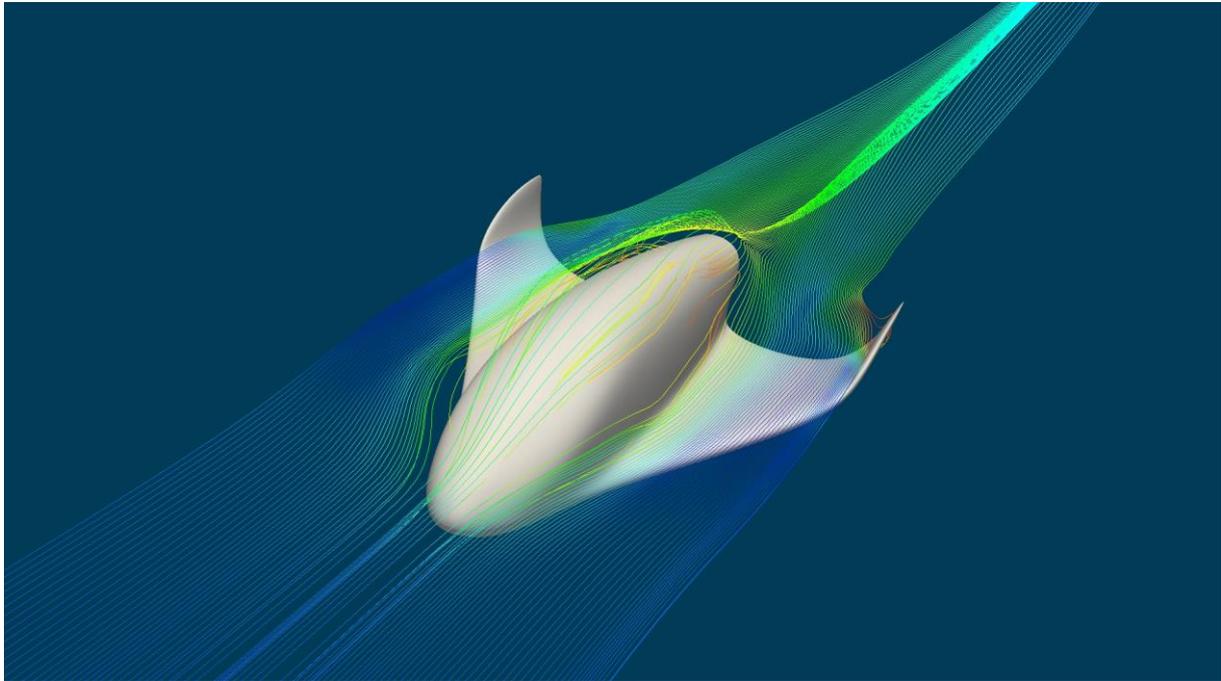


# Spacecraft Aerodynamics LES Simulation Using LBM Code Palabos



## Description

This project shows how to simulate an external flow around a spacecraft using large eddy simulation or LES method. At the inlet an inlet velocity of 5 m/s is set as inlet boundary condition, whereas the spacecraft is defined as no-slip wall boundary condition.

Turbulence model: Smagorinsky LES model with constant  $C = 0.14$

Velocity as inlet boundary condition (Velocity  $U = 5$  m/s)

Walls = No-slip boundary conditions

Simulation domain size:

$x = 2.95$ ,  $y = 0.9$ ,  $z = 0.9$

Kinematic viscosity =  $0.001$  m<sup>2</sup>/S

Total simulation time = 4 S

Grid resolution along the y-axis direction = 120

### **Case directory contains following files:**

1- externalFlowAroundObstacle.xml

This file contains information regarding geometry, mesh, and simulation parameters. This file can be opened using any text editor like e.g. Notepad++

2- makefile

This is also a text file which contains information regarding compiling the code.

3- externalFlowAroundObstacle.cpp

This file again is a text file and basically it's a part of the Palabos library.

### **How to run the simulation**

#### **Step 1 Compile the code:**

First you need to compile the code running following command from within your working directory:

```
make
```

Run in parallel

If you want to run the simulation in parallel then you have to change (using text editor) "SMPparallel" value from false to true and then run the following command from within your working directory:

```
make
```

#### **Step 2 Run the simulations:**

Now you have to run the following command from within your working directory:

```
./externalFlowAroundObstacle externalFlowAroundObstacle.xml
```

#### **Step 3 View results:**

Launch Paraview and navigate to the following folder within your working directory and load these two files:

```
tmp\ volume.vti
```

```
tmp\ obstacle_LB.stl
```

### **Notes:**

- Link to download Palabos code:

<https://fetchcf.com/view-project/1193>

- Link to install Palabos code:

[https://palabos.unige.ch/files/9515/6509/3036/Palabos\\_UserGuide.pdf](https://palabos.unige.ch/files/9515/6509/3036/Palabos_UserGuide.pdf)

- Link to free download Paraview software:

<https://www.paraview.org/download/>

- Link to free download simulation files from FetchCFD.com

<https://fetchcfid.com/view-project/1592>