

# STUDY OF FLOW CONTROL MECHANISMS WITH OPENFOAM

Budged

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## 1 Direct cost

In Table 1 are detailed the task develop during the Thesis. The price per hour has been set as 20 € /h

<b>Task</b>	<b>Level of effort (hours)</b>	<b>Cost €</b>
<i>Problem definition</i>	18	360
<i>Understand OpenFOAM methodology</i>	60	1200
<i>Solver selection</i>	12	240
<i>Learn grid generation with Salome</i>	18	360
<i>Learn postprocessing data with paraView</i>	18	360
<i>AFC performance description</i>	18	360
<i>AFC simulation methodology</i>	30	600
<i>Remote computation access methodology</i>	18	360
<i>Computational domain definition</i>	35	700
<i>Boundary layer grid design</i>	50	1000
<i>Boundary conditions</i>	12	240
<i>Grid independence test</i>	24	480
<i>Grid selection</i>	6	120
<i>Baseline case run</i>	12	240
<i>Postprocessing of the baseline case</i>	52	1040
<i>Validation of the results</i>	10	200
<i>AFC placement</i>	44	880
<i>AFC implementation</i>	120	2400
<i>Run of cases with AFC</i>	30	600
<i>Postprocessing of each AFC case</i>	100	2000
<i>Comparison of the results</i>	60	1200
<b>TOTAL</b>	<b>680</b>	<b>13600</b>

Table 1: Direct cost of the Thesis.

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## 2 Indirect cost

In Table 2 are detailed the indirect costs associated to the Thesis. This includes the cost of computational time, where the High Performance Computing (HPC) has been used from CIMNE cluster. The price have been stimaed with the cost of Amazon clusters [**Amazon**]. It has to be noted that the software has been also been included, in this case, all software was open-source. The Hp is one laptop for the whole time. [**Hp**]

<b>Computer Resources</b>	<b>Renting (hours)</b>	<b>Cost €</b>
<i>HP - ProBook I-Core i5</i> [ <b>Hp</b> ]	-	980
<i>HPC - CIMNE</i> [ <b>Amazon</b> ]	720	3600
Salome	-	0
OpenFoam	-	0
ParaView	-	0
<b>TOTAL</b>	<b>720</b>	<b>4580</b>

Table 2: Indirect cost of the Thesis.

HPC specification:

- CPU model - Intel Xeon E5-2660 v2
- Cores per node - 20
- Memory per node - 128GB

Finally, the total cost of the Thesis can be found in Table 3

<b>Type of Cost</b>	<b>Cost €</b>
<i>Direct Cost</i>	680
<i>Indirect Cost</i>	4580
<b>TOTAL</b>	<b>5269</b>

Table 3: Total cost of the Thesis.

The total cost have been estimated to be **5269 €**