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Numerical study of fluidic oscillators with compressible flow

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BUDGET

Budget

The aim of this document is to determine the economical expenses of this study, taking into account the labour costs of the engineers, the licence costs, the costs of the hardware and its maintenance, etc. All the expenses below are summarized in table 1.

Firstly, the labour costs must be divided into different stages of the project, as there is a wide range of requirements according to the stage. The highly qualified tasks are the case preparation (including the mesh refinement), the simulation and the extraction of results and its proper analysis. The hourly cost of those tasks is 14 €. The research on the background, state of the art and theoretical framework correspond to a medium qualified work, and its hourly cost is 12 €, as well as the formation in the CFD software. The redaction of the report is worth 10 € per hour.

Secondly, this study has the advantage of using a licence free software, OpenFOAM® and other gnu public licence utilities for Linux. For this reason, no additional costs are added by the software. Nevertheless, the hardware must be recouped. Its initial price is 3000 €. Moreover, a permanent electric supply for the computer cluster and the laptop from where all the work has been done must be taken into account. The cluster is considered to remain in standby mode most of the time. The electric consumption in standby is 2.34 W. The duration of this study has been 1 year, or what is the same, 8760 h, so that makes a consumption of 20.49 kWh for each computer of the cluster. The cluster is formed by 5 computer so its final consumption is 102.49 kWh. The laptop computer is considered to be ON (50,56 W) during the labour hours, and the rest of the time remains in standby. Its cost ascends to: $440 \times 50.56 W/1000 + (8760 - 440) \times 2.34 W/1000 = 41.7152 kWh$

The current approximate cost of the electricity in Spain is 0.15 €/kWh, so that makes 9.33 € spent in electricity by the computers.

Other additional expenses such as the project printing have been estimated, and its cost is 30 €.

Labour costs			
Task	**€/h**	**Time (h)**	**Total Cost**
Background and state of the art researh	12	50	600 €
Theoretical framework research	12	100	1200 €
CFD formation	12	20	240 €
Case preparation	14	100	1400 €
Simulation	14	100	1400 €
Results extraction and analysis	14	50	700 €
Report redaction	10	20	200 €
Software and Hardware related expenses			
Task	**Total Cost**		
OpenFOAM® GNU licence	0 €		
Cluster	3000 €		
Laptop computer	1000 €		
Electricity expenses			
Task	**€/kWh**	**kW**	**Time (h)**	**Total Cost**
Cluster electricity expenses (STANDBY)	0.15	0.00234	8760	3.07 €
Laptop electricity expenses (ON)	0.15	0.05056	440	3.34 €
Laptop electricity expenses (STANDBY)	0.15	0.00234	8320	2.92 €
Other expenses			
Task	**Total Cost**		
Project printing	30 €		

Table 1: Summary of the costs of the project

To sum up, the total cost of the project is 9779.33 €.