UNIVERSITAT POLITÈCNICA DE CATALUNYA
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BACHELOR FINAL THESIS

Study of car aerodynamic forces modification with mirror suppression via CFD

Document:

Budget

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Budget breakdown

This budget is presented in order to reflect the costs that it would have taking into account that it has been performed inside an academic entourage. This will have a clear effect on the costs considered as the cost for a Junior Engineer is greater that the one for a student or the costs of some licenses is not going to be considered as they are provided by the university and covered by the tuition fees.

1.1 Human resources

The first costs that are going to be considered are the ones associated with the hours dedicated by the personnel involved. In this thesis only the director of the thesis, Dr Josep Maria Bergadà Granyó, the student and Dr. Moritz Lehmann have been involved. For the director of the thesis an associated cost of 25,00 €/h has been used, for Dr. Moritz Lehmann a cost of 18,00 €/h is considered while for the student, the hourly cost is of 10,00 €/h.

In the table below, a breakdown of the activities and the cost associated can be found:

Task	**Hours**	**Cost per hour [€/h]**	**Total cost [€]**
Project charter	7	10,00	70,00
Meetings with Dr. Bergadà	50 (each)	30,00	1.500,00
CAD model	50	10,00	500,00
Meshing	70	10,00	700,00
Research on software	25	10,00	250,00
Research on LBM	50	10,00	500,00
Meetings with Dr. Lehmann	25 (each)	28,00	700,00
FluidX3D familiarization	25	10,00	250,00
Setting the simulations	40	10,00	400,00
Analysis of the results	70	10,00	700,00
Post-processing coding	110	10,00	1.100,00
Report elaboration	90	10,00	900,00
Total	**687**	-	**7.570,00**

Table 1.1: Tasks with time and cost associated

As the meeting hours have to be taken into account for both people but it has been considered the added cost of both, the meeting hours have to be added twice to the total while for the cost, the total is directly the sum of those above.

1.2 Execution costs

Once the personnel costs have already been considered, the execution costs have to be considered. This type of costs include the amortisation for the machinery necessary as well as all the licenses, but also the energetic cost derived from the project.

1.3 Resources and licenses

For the project, only the home computer used for the simulations can be assigned as resources needed and all the licenses used are either free or come with the tuition fee payed. So the costs breakdown is as it follows:

Resource	Cost per unit [€/h]	Amortisation [%]	Total cost [€]
Home computer	1.700,00	10,00	170,00
Subtotal	-	-	**170,00**
License	**Units**	**Cost per unit [€/h]**	**Total cost [€]**
Overleaf	1	0,00	0,00
Matlab	1	0,00	0,00
ParaView	1	0,00	0,00
Jupyter	1	0,00	0,00
Subtotal			**0,00**
Total			**170,00**

Table 1.2: Costs associated to the resources and licenses necessary

1.4 Energetic costs

In order to calculate the energetic costs associated to the project, it has been established that the computer power consumption is of 250 W. Keeping this in mind,

Machinery	Hours	Cost [€/kWh]	Total cost
Home computer	800	0,27	54,00
Total	800		54,00

Table 1.3: Energetic costs

1.5 Overhead

Once the above costs have been calculated is necessary to add the overhead costs that account for running the business associated with the project. This costs can be extracted as the 20 % of the sum of the costs presented above. Therefore, the overhead costs account for 1.548,00 €

1.6 Total costs

Finally the total (direct plus indirect costs) can be calculated as:

Concept	**Cost [€]**
Direct costs	7.740,00
Indirect costs	1.548,00
Subtotal	9.288,00
VAT	1.950,48
Total costs	11.238,48

Table 1.4: Total costs associated with the project