

BACHELOR THESIS

**Study of the functioning and importance
of diffusers in Formula 1 cars**

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BUDGET

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1 Budget

This section presents the cost of the development of this project. All the prices per hour are defined without considering the IVA fee.

1.1 Direct costs

Direct costs are the prices that can be directly related to the realization of a service or the production of specific product. In this case, as no product is being manufactured, the direct costs are considered the time spent researching and investigating about the field of study involved. All the activities done during the development of the project are added to count the corresponding costs. The price per hour is considered to be 15€, which a normal junior engineer could earn per hour. The amount of hours spent per each activity was noted every day from the start of the project in an Excel file – in Sec. ?? the percentages of hours spent on each activity is presented.

| Activity | Amount of hours [h] | Price per hour [€/h] | Subtotal [€] |
|---|------------------------|-------------------------|-----------------|
| Project Charter | 3 | 15 | 45 |
| Research of information | 30 | 15 | 450 |
| Documentation | | | |
| Report | 50 | 15 | 750 |
| Budget | 5 | 15 | 75 |
| Annex A - OpenFoam familiarization | 2 | 15 | 30 |
| Annex B - Planification | 2 | 15 | 30 |
| Simulations | | | |
| Installation of Ubuntu 18.04 LTS, OpenFoam 7 and ParaView 5.4 | 1 | 15 | 15 |
| Software familiarization | 67 | 15 | 1005 |
| Geometry | 11 | 15 | 165 |
| Creation and validation of mesh | 35 | 15 | 525 |
| Simulation computation time | 81 | 15 | 1215 |
| Post-processing | 5 | 15 | 75 |
| Analysis of results | 8 | 15 | 120 |
| TOTAL | 300 | | 4500 |

TABLE 1.1: Direct costs of the project

1.2 Indirect costs

In this section, the indirect costs involved in the project are defined. These indirect costs are related to the material used during the realization of the project. Two indirect costs are determined. First, the computer used is added in the budget as, maybe it is considered an essential resource to carry out the study. Otherwise, the power consumption is also considered an indirect cost as it is needed when using the computer doing the report or while simulations were being performed. It is supposed that the computer used consumes 200 W, hence 1.6 kWh working 8h. Considering 50 days using the computer every day 8h per day results in 80 kWh. All the prices are defined without considering the IVA fee.

| Concept | Quantity | Price per unit [€/unit] | Subtotal [€] |
|-------------------------|----------|----------------------------|-----------------|
| Computer | 1 | 1100 | 1100 |
| Power consumption [kWh] | 90 | 0.1031 | 9 |
| OpenFOAM license | 1 | 0 | 0 |
| TOTAL | | | 1109 |

TABLE 1.2: Indirect costs of the project

1.3 Total costs

Finally, the total costs are the sum of the direct and indirect costs of Sec. 1.1 and 1.2 – this costs are calculated without the 21% IVA. Then when the sum of both these costs is obtained, this 21% IVA is added to finally obtain the total costs for the development of this project.

| | |
|---------------------|----------------------|
| | Total [€] |
| Direct costs | 4500 |
| Indirect costs | 1109 |
| TOTAL (without IVA) | 5609 |
| 21% IVA | 1178 |
| TOTAL | 6787 |

TABLE 1.3: Total costs of the project