



Venus Project | Newsletter

July 2016

ONGOING OF PROJECT

In this second newsletter we would like to present you to the ongoing of Venus project. Significant advancements have been done in the project during these months and we would like to share them with all of you.

Venus Motor Design

Summary of the Year

In this last year, the VENUS motor became reality. Once that the performance of the motor was evaluated in detail with simulations, the mechanical design of the motor was undertaken.



In the first part of the year, Venus team has focused on design in detail the mechanical configuration of the motor.

Not only mechanical aspects, all control related issues have been also covered in these first months. Real aspects of the control such as the selected resolver resolution, noise in the control and computation limits of the processor have been tested in simulation.

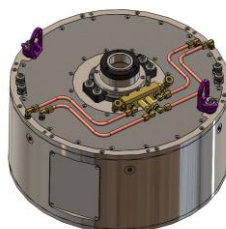
In the second part of the year, all the design became reality. The different pieces of inverter and the motor have been manufactured and mounted. Also all the code of the control has been generated and tested in the real electronic hardware of the control unit (ECU).

Now, VENUS team is focused on testing the different aspects of the motor such as

mechanical performance, electromagnetic characterization and inverter and motor control.

The electric motor Mechanical Design

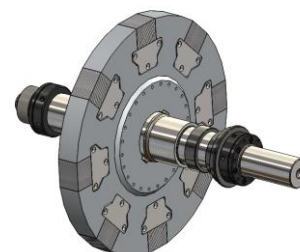
The mechanical design of the motor has been a very challenging task. On the one hand, the prototype has been designed for an easy installation in the Van. On the other hand, the motor is going to be also tested in a test bench. This double installation requirement, makes that many of the solutions for a compact mounting in the Van makes unfeasible the mounting in the test Bench. The solutions adopted has "sacrificed" in certain way the final compactness of the prototype to facilitate the mounting process of the motor not only in the Van, also in the test Bench. In the following figure, the final design of the motor can be observed.



In most of the cases the accuracy that can be achieved with prototype manufacturing processes is higher than more usual processes in mass production.

VENUS team managed to construct the prototype of a novel Axial Switched Reluctance for electric vehicle application

However, in case of the laminations where for mass production the stamping is employed, the accuracy of the mass production is higher than the accuracy of processes that can be used in prototyping (Laser cutting, WEDM). That is why the mounting has to be carefully planned to compensate the accuracy errors of the pieces produced by prototyping. In the rotor some mounting pieces have been designed for the correct compensation of these inaccuracies.



The Inverter Mechanical Design

In case of the Inverter, the mechanical design has been influenced by the Axial nature of the motor.

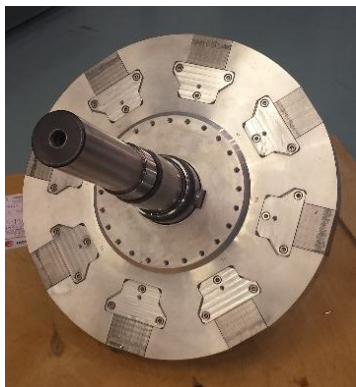
The large diameter of the motor imposes a different position of the motor and the inverter comparing with more typical configurations based on radial motors. Obviously this had strong impact on the final geometry of the inverter.



Venus Motor Manufacture and Test

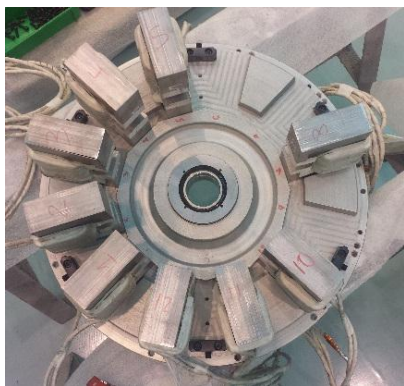
Manufacture of Venus Motor

Each part of the VENUS motor has been carefully assembled to maintain the maximum accuracy in the prototype. The sub-assemblies have measured one by one to assure the correct manufacturing of the pieces and the assemblies. In the following figure, the rotor of the motor can be seen.

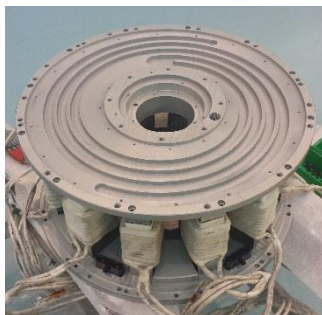


The different poles of the motor are assembled using pieces specifically designed to press and locate correctly the lamination poles in the rotor.

In case of the stator, the C cores have been assembled one by one using positioning pieces.



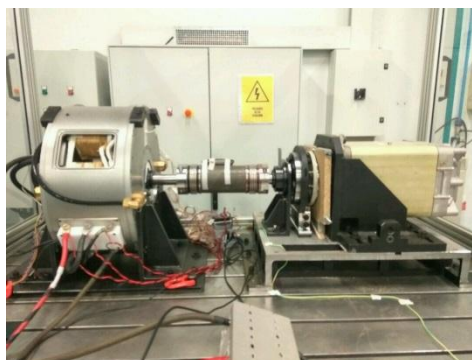
Once that the stator and rotor have been assembled, the motor has been completed and closed with the cooling tapes.



The cooling of the motor employed a spiral cooling circuit designed using CFD simulations.

Finally, the motor has been completely assembled and mounted for the tests in the test Bench.

The developed code controls the Torque of VENUS motor, the speed is fixed by another motor in order to be able to evaluate the performance of VENUS motor at different working points.



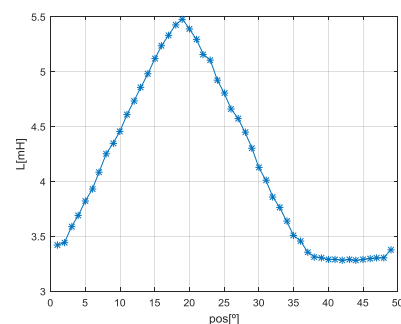
The control and the power electronics are well suited in their respective control and power boards developed by VENUS team in the Inverter unit of VENUS project



Test of the Motor

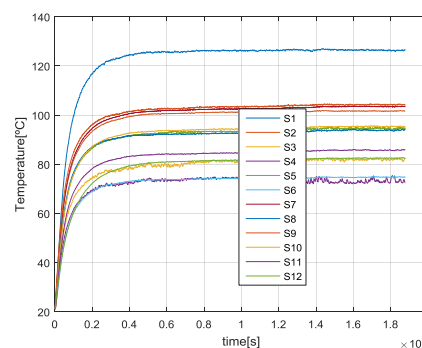
At present, different test are being carried out. From the most basic tests for the posterior control tuning, to the advanced ones for the motor performance evaluation.

In the following figure the experimental inductance can be seen.



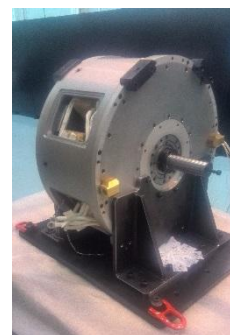
The variation of the inductance is a key parameter for torque generation and the correct determination of the control parameters. Thus, is essential to know the inductance shape as well as possible to optimize VENUS motor performance.

Not only, electromagnetic, thermal tests have also been carried out to confirm the correct heat evacuation in the motor by the cooling. The motor has been equipped with 25 thermocouples.



Upcoming step

The next meeting of VENUS team will be hosted by *The University of Mondragon* and will be the final meeting where the VENUS motor will be shown integrated in a Van.



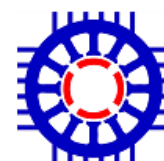
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FOR MORE INFORMATION

For more information please visit the VENUS project website:

<http://www.venusmotorproject.eu>

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