

## PERFORMANT POWER TRAIN FOR HYBRID AND ELECTRIC VEHICLES WITH DUAL ROTOR SINGLE STATOR AXIAL SYNCHRONOUS MACHINE AND SINGLE INVERTER - HELSAX

### Goal of the project:

The project goal of bilateral cooperation between the UPT-TUIASI and UTM proposed, is of major scientific and practical importance in reducing pollution from vehicles classic using hybrid vehicles or electric drive systems performance, and aims to develop and enhance knowledge of joint research teams from Romania and Moldova, as well as enhance mobility of researchers, exchange of experience and mutual access to research infrastructure of medium and high scale, existing in the three universities.

The basic priority of the collaboration is to develop, during the implementation of the joint project, of a scientific project for participation in competitions announced by Horizon 2020 of the European Union and other international programs.

### Short description of the project:

It proposes an international original solution in which the two electrical machines (generator and motor) and static converters related are replaced by a single synchronous permanent magnet machine having axial air gap, a central stator with slots on both sides and two different windings supplied from a single PWM inverter having two output frequencies, and two independent rotors.

### Project implemented by

Politehnica University Timișoara (UPT),  
Technical University "Gheorghe Asachi" Iași (TUIASI) and  
Technical University of Moldova (UTM)

### Implementation period:

September 2016 – March 2018

### Main activities:

The aim is to exploit the potential of joint research of the two teams for creating a system of electric drives for hybrid vehicles and electrical overall dimensions and low weight; reduce carbon emissions from vehicles; have a static converter that is simple and inexpensive; broadcast transmission system using differential electric vehicles; control of the two rotors so that they can operate in the same mode or in different modes at the same rotational direction or in opposite directions at the same speed value at slightly different speeds or at much different speeds. Specific objectives: increasing electrification of the vehicle; reducing vehicle weight; increasing the speed of operation of the electrical machine rotors for reducing the size of the actuator; sizing model for which the design (impose conditions of power, size, weight); design model for the electric drive system and the stand of experimental tests; increasing efficiency

for the electric drive system; the practical design of the machine, inverter and battery accumulators; exhibition experimental test setup; implementation and testing of the various experimental control solutions; creating an intelligent system for managing production and electricity consumption per vehicle. Expected results: a much easier vehicle with an electric drive system; low inertia rotor at high speeds; a compact electric drive system with high torque and simple control; an inverter that manages various operation modes with different speeds equal to or in the same direction or in opposite directions of the two rotors.

### Results:

The work plan in 2016 was based on regular meetings of members of both teams alternately in Romania and Moldova. First visit was in Moldova, by a team from Romania. On this occasion the Romanian members met the team members from Moldova, visited research labs, they did contact with their scientific concerns. During this movement, a conference occurred, in order to launch the project in Chisinau, where teachers and students from the Technical University of Moldova and specialists in electrical engineering enterprises in Chisinau, Balti and Tiraspol were invited .

Then followed a visit by a team from UTM to Faculty of Electrical Engineering and Energetics in Timisoara and the Faculty of Engineering Hunedoara. On this occasion contact were established with all members of the project team from Romania, were visited research laboratories of the two faculties, and there was group discussions between members of both teams according to scientific areas of joint research. One conference was organized in order to launch the project in Timisoara, where teachers and students at the University Politehnica Timisoara and specialists of enterprises of Timisoara and Arad with automotive profile were invited. There was a travel team from Chisinau to visit industrial companies in the automotive industry in Hunedoara and Deva (Lisa Draexlmaier Hunedoara, Sews Deva).

## Applicability and transferability of the results:

The motors excited by permanent magnets in a variety of designs, gaining more ground in the competition with the DC classics, because of high technical and economic achievements, especially under current conditions, in association with improved electronic supply sources and assisted computer systems that are more and more competitive. Obtaining reasonable torque values for a wide range of variation of speed, drive systems through simple procedures, are no longer a difficulty that cannot be solved. Using motors excited by permanent magnets and brushless fractional number of slots per pole and phase engines in particular, as actuators in servo-drives for low power and area, has expanded compared to the classic DC due to the progress of power electronics and information technology, without which one can not conceive an elastic system containing modern drive controllable speeds in wide range. With integrated systems for the electric drive, having adequate topologies actuators as execution elements, through the use of more evolved control algorithms and integrating functionality at both hardware and software, may lead to dynamic and superior performances, more precise control of speed or position, high electromagnetic torque, higher energy efficiency and high accuracy while simultaneously reducing overall system cost consistently. The project results will contribute to community social objectives to combat climate change. The main contribution is to reduce emissions of CO<sub>2</sub> and emissions of greenhouse gases. The project proposes new technologies and contributes to sustainable economic development.

## Financed through/by

UEFISCDI

## Research Center

UPT members of the research team are also members of the University's two research centers: the Institute for Renewable Energy and Research Centre for the intelligent control of power conversion and storage.

## Research team

The research team consists of UPT coordinator Assoc. Prof. Sorin Ioan DEACONU, PhD, teachers (PhD's): Nicolae MUNTEAN, Lucian Nicolae TUTELEA, Liviu MIHON, Octavian CORNEA, Ciprian ȘORÂNDARU, Marcel TOPOR, engineers and PhD students: Loredana GHIORMEZ and Csaba GHEORGHIU.



Informbusiness Chișinău laboratory for experimental work.



Helsax project launch conference in Chisinau.



Helsax project launch conference in Hunedoara.

## Contact information

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