Press release

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ON THE WAY TO A CLIMATE-FRIENDLY COMMERCIAL VEHICLE

Successful completion of the AIT-led project eCVT: Development of an electrified drive concept to avoid emissions while simultaneously increasing efficiency

Vienna (AIT): With a share of 30 percent, the transport sector is one of the largest CO2 emitters. Thus, there is still a great need for action in this sector in order to achieve the climate targets. This applies not only to private transport, but also to municipal and commercial vehicles, which are mainly used by local authorities for their tasks. These vehicles are mostly modular in design and are used in a variety of ways, for example to clear roads in winter, to mow embankments, to manage refuse collection or to clear undergrowth in the forest.

In this vehicle class, a hydrostatic hybrid drive system has become established in recent years. The hydraulic unit can support the drive, provide propulsion alone, or even be used to operate the auxiliary equipment of a typical municipal vehicle (e.g. lawn mower module). A so-called CVT transmission (Continuously Variable Transmissions) is used, as it controls the vehicle speed independently of the engine speed. In this way, for example, attachments can be operated at a high engine speed when power requirements are high, while at the same time the vehicle speed is optimally adjusted to the respective work process.

However, these continuously variable transmissions are characterised by high losses and therefore high emission values, especially in the partial load range - a decisive disadvantage on the way to achieving the climate targets.

eCVT: Significantly higher efficiency through electrification in hybrid transmission design

This is where the "eCVT" research project led by the LKR Light Metal Competence Centre Ranshofen of the AIT Austrian Institute of Technology comes in: Together with six partners from research and industry (Miba Battery Systems, VDS Getriebe, Linz Center of Mechatronics, Bitter, AIT Austrian Institute of Technology/Competence Unit Electric Vehicle Technologies, Reform-Werke, Miba Sinter Austria), a new type of transmission unit was developed that can compensate for the disadvantages of conventional CVT units, especially in the partial load range, thus ensuring higher efficiency with significantly lower emission values.

The aim of the project was to replace the hydraulic variator unit in an existing transmission with two electric machines. Two highly compact, innovative and cost-effective electric drives were used in generator and motor operation, with all components of the eCVT unit being specifically developed, manufactured and assembled. By complementing the drive concept with the electric machines and a battery storage system, a significant increase in the efficiency of the overall system was achieved while simultaneously reducing pollutant emissions. The eCVT unit offers greater flexibility, enables

short-term overload and allows recuperation of kinetic energy during braking.

AIT expertise in drive technology, die casting and wire-based additive manufacturing

Researchers from the Electric Vehicle Technologies Competence Unit at the AIT's Center for Low-Emission Transport contributed their extensive expertise and infrastructure in the field of electric drive control to the project. As the eCVT unit consists of two machines of different designs, independent, coordinated control software for the motor and generator was designed and programmed in intensive cooperation with VDS. Subsequently, the hardware and software of the individual motor-inverter subsystems were validated on the drive test bench, particularly with regard to dynamics, robustness, thermal behaviour and energy efficiency. A special challenge for the project consortium was the seamless change between torque and speed control, which had to be carried out quickly but continuously without inadmissible electrical or mechanical load peaks - in each case according to the different operating modes of the overall system.

In addition to coordinating the project, the researchers at the LKR Leichtmetallkompetenzzentrum Ranshofen contributed their expertise in the fields of die casting and wire-based additive manufacturing (WAM). To ensure the cooling of the electrical units, a housing with a correspondingly innovative cooling system was developed at the LKR and executed as a prototype in a novel hybrid cast-welded construction. In a first step, the highly complex aluminium component was cast using a low-pressure casting process and then finished by applying material using the WAM process.

Successful project completion: eCVT transmission unit as a contribution to significant emission reduction

Lukas Kiessling, researcher at the LKR Light Metal Competence Centre Ranshofen, explains: "Within the framework of eCVT, we have succeeded in developing a completely new type of transmission unit, validating it in simulation and on the test bench, and ultimately successfully installing the prototype in a vehicle and testing it by means of a test drive." Simon Frank, eCVT project manager and die casting expert at LKR, adds: "A continuously variable transmission with electro-mechanical power split and electrically driven variator has great potential as a core element for novel hybrid drives in light vehicles. This leads to a significant reduction in consumption and noise, as well as greater flexibility in use for future mobility applications."

Further informationen

- AIT Center for Low Emission Transport
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