

Pressemitteilung

Press Release

Automotive Engineering can be Fun – ika creates Hybrid Vehicle with Lego bricks

Within the project ASTE, engineers and students from the Institute for Automotive Engineering (ika) of RWTH Aachen University have built a scale model Unimog with fully functional hybrid drivetrain, comprising generator, NiMH battery, battery management system and vehicle control unit, using only Lego bricks.

It may sound like yet another gadget from a child's playroom when talking of those studded plastic bricks, but ika's Lego Unimog U400 Plug-in Hybrid is far more than that. It is a fully functional scale model hybrid vehicle, complete with all necessary components. Mechanically, the vehicle is a parallel hybrid based on the original all-wheel-drive model. Its combustion engine of course does not run on diesel but is propelled using two electric motors with a normal battery pack and yielding a total of about 4 watts. The motor/generator unit in the hybrid branch delivers a maximum of approximately one watt. The plug-in traction battery (NiMH, 8.4V, 1.26Wh) is controlled by a dedicated battery management system and the overall vehicle control unit based on Lego's Mindstorm NXT robotics system. The vehicle is operated via an infrared remote control. The electric driving range is limited, partly due to the increased weight of about 5 kilograms. As a workaround to this constraint, a 4x4 dynamometer was made from Lego to allow for wired driving tests.

The simulation environment for the vehicle control unit was programmed in Mindstorms as well as Labview and Matlab. The operating strategy was designed to automatically select the best modes like boosting,

combined hybrid mode and braking energy recuperation or recharging. The vehicle metrology consists of a triaxial accelerometer, two speed sensors and an IR interface.

Students and pupil interns created three additional model cars with different drivetrain features.

The first vehicle includes a Haldex-type differential and a fixed value lock differential. The second vehicle features a switchable four-wheel drive system that can disengage the front or the rear axle. The fourth vehicle is a regular four-by-four layout acting as a packaging and weight analysis demonstrator for pupils and students.

The research project ASTE is an EU/INTERREG-funded project with partners from Belgium, the Netherlands and Germany. Its aim is to develop a comprehensive concept of didactic modules in the field of vehicle propulsion technologies, with respect to a wide range of target audiences in the Euregio Meuse-Rhine. Its goal is to make these technologies easy to understand and to make them tangible. Coordinated by Campus Automobile Spa Francorchamps a.s.b.l., a number of models were realised in the past three years to raise the technology awareness among young people – from children to pupils deciding which profession to take up. The playful aspect of the vehicle models supports the aim to understand and learn about the corresponding technologies. In the course of the project, several seminars and lessons were supported by some of the models, for example during the RWTH Kinder-Uni.

Now, after completion of the project, the items continue to be used in such events and for the dissemination of knowledge at schools to introduce children to vehicle technology. To symbolically launch the next phase, the four Unimogs engaged in a race on the Spa Francorchamps Formula One circuit on 17th January 2014.

For the accompanying students, this was an impressive highlight of the hybridisation efforts. The four scale model cars completed a full lap of the 7 kilometre-long race track in the picturesque Belgian Ardennes. Reflecting advantages and disadvantages of each technology, the outcome was a close call between the four versions, yet again underlining the joy an engagement in vehicle drivetrain technology can offer. The fictional race report can be downloaded from the ika website.

[www.ika.rwth-aachen.de]

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