

electric & hybrid

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THE

GREAT

EV

We investigate EV range claims and discover how the all-new WLTP standard will shake up development of battery vehicles forever

LIE?

TOP CAT

The launch of the I-Pace SUV is not just big news for Jaguar, it's a massive momentum shift for the EV movement

ON A MISSION

It's not easy chasing down Tesla, but that's what Michael Steiner, Porsche's R&D guru, is aiming for as launch of the Mission E nears

RACE READY

As JLR and Audi join Formula E, will the electric racing series become the number one motorsport competition?

Optimizing transmissions

As development of EVs and HEVs continues, CAE design, analysis and simulation are key to ensuring complex transmission systems meet the automotive industry's requirements

► For a long time, CAE software has played a vital role in an engineer's ability to achieve levels of innovation beyond those obtainable through manufacturing and testing prototype systems. Requirements are significantly increasing year on year, and CAE software has had to keep up with the demands presented by the automotive sector.

The challenges facing today's automotive transmission engineers include ever-rising expectations of the performance and characteristics of complex modern transmissions, where electric and hybrid are fast becoming king.

As the noise that combustion engines generate is eliminated by electric drive modes, the vehicle driveline's contribution to overall noise is an increasingly significant factor. The tell-tale high-pitch whine of a vehicle's transmission is a common characteristic of EVs and hybrids during electric drive modes and has become an issue across the industry.

Software such as SMT's MASTA can considerably reduce the time it takes to design and analyze these advanced transmission systems. Engineers are able to predict key performance characteristics and identify the root cause of failures or weaknesses at the design phase of the development cycle.

MASTA's detailed gear geometry analysis features enable a user to quickly generate virtual contact patches, simulate transmission error and perform advanced durability analysis such as predicting tooth interior fatigue fracture, and much more. Most importantly in terms of gear whine, NVH analysis can be performed to identify audible frequencies and the sources of excitation in a full driveline system.

Furthermore, with finite element analysis (FEA) features, casing

meshes can be imported and analyzed to minimize resonance and response to frequencies generated by the components of the internal gearbox.

These noise characteristics were traditionally picked up during the project's physical prototype phase and analyzed under rig and test track conditions. The cost and time associated with this has led engineers to use FEA packages to help deduce the sources of excitations and frequencies by looking at individual components. Performing FEA in this manner doesn't take into account the full system and the nature of multiple components acting on one another. This is where a full system analysis CAE package such as MASTA can

save a substantial number of man hours, enabling a user to analyze components such as gearsets, bearings and electric motor excitations in the context of the components around them.

Another prominent feature is MASTA's parametric study tool. This enables the user to calculate an array of multidimensional results by providing a simple parameter input range. An example would be performing a Monte Carlo study to simulate manufacturing tolerances on a system's microgeometry and see how these variances would impact transmission error.

Complex, flexible multibody dynamic analysis has also posed a challenge for automotive engineers. A series of CAE modules called

Driva can simulate dynamic events within the time domain, for example, allowing hybrid vehicle engineers to simulate the switchover between the combustion engine and the electric motor, which could result in unwanted excitation that is felt through the gearbox.

With the sustained push toward electric and hybrid vehicles and an increasing trend toward fully integrated systems such as hub drives, CAE design, analysis and optimization will continue to play an integral role in the transmission innovations of tomorrow. ©

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INQUIRY NO. 518



SMT's MASTA software program can significantly reduce the time needed to design and analyze advanced transmission systems