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MAKING THE MOST OF HYBRID ELECTRIC VEHICLES

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In a world where petroleum supplies are shrinking and global temperatures keep inching higher, hybrid electric vehicles (HEVs) are a smart choice.

With both gas and electric motors under the hood, these cars enjoy the best of both worlds.

At low speeds, HEVs can take advantage of the energy-efficient electric motor. Not only are these motors inherently more efficient than their gas-powered counterparts, they can also draw on the energy captured during braking.

When serious power is required, however — for high-speed driving or sudden acceleration, for example — the conventional engine kicks in.

That creates a key design question: when to switch from one engine to the other for greatest fuel efficiency.

Systems design researchers at WISE recently developed a mathematically optimal feedback controller designed to address that challenge. By using prior knowledge of the upcoming driving conditions, the controller can select the best engine for the job at any given moment.

On top of that, the investigators were able to narrow down the amount of data about the future driving conditions the controller needs. They settled on three key pieces of information: the time when power is needed for acceleration, the time when power is needed for cruising, and the amount of energy that can be captured during braking until the next stop. The result is real-time optimization that doesn't demand hefty number crunching.

By choosing the most efficient engine, the controller can cut fuel consumption along with planet-warming carbon emissions. Thanks to a little optimal control theory, a smart transportation choice just got smarter.

Partners: the Natural Sciences and Engineering Research Council of Canada, Toyota, Maplesoft, the Ontario Centres of Excellence