

The role of dynamics and control in cutting vehicle CO₂ emissions

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Abstract

There are only two ways of cutting CO₂ emissions from road vehicles: either i) by eliminating carbon from the propulsion source, or ii) by dramatically improving vehicle efficiency. Adopting either of these options affordably is by far from easy. This plenary lecture will focus on areas of vehicle technology where dynamics and control can be used expediently to improve vehicle efficiency for conventionally powered vehicles, Hybrid Electric Vehicles (HEV), and (battery) Electric Vehicles (EV). For example, in both conventionally-powered vehicles, and HEV, there are significant benefits of closed-loop combustion control to improve engine thermal efficiency and performance using different fuels. The state of indirect cylinder pressure sensing will be discussed. Another application where significant fuel economy improvements are possible in IC engines, is to replace the liquid cooling with evaporative cooling a novel approach to control two-phase spray evaporative cooling will be outlined. Yet another area for CO₂ emission reduction for HEV is the adoption of advanced Range Extender concepts. And a final example (where a novel optimal control approach will be discussed) is optimal flywheel-based kinetic energy recovery that offers durable vehicle range extension for both EV and HEV. In summary, a broad overview will initially be given of areas where dynamics and control alone can engender significant improvements in vehicle efficiency. Some of the realizable benefits and implementation challenges will be examined for the topics mentioned.

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