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Sommario/riassunto	Long description: The aim of this thesis is to establish a coupled modeling approach to simulate fuel consumption and in-cylinder gas emissions of a passenger car in various driving cycles (NEDC, RDE, WLTP). Combining models of the engine control unit and the mechanical vehicle powertrain with a crank-angle based combustion engine simulation opens up the possibility to support the development and calibration of future engines, demonstrated here for a turbo-charged spark ignited engine with direct injection and a fully-variable valvetrain. Thermodynamic processes are implemented within a 1D gas exchange model which allows to consider not only steady-state but also transient engine operation. The coupled system is extended by calculations of engine-out emissions considering the formation of nitrogen oxide (NOx), carbon monoxide (CO), and hydrocarbons (HC). Furthermore, tailpipe emissions are determined in an additional simulation model. The successful validation of this complex coupling technique is presented with exemplary results from all stages of the validation process. Finally, the advantage of this simulation methodology is shown by several application examples demonstrating the attained capabilities.