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The Effects of Two-Stage Cam Profile Switching and External EGR on SI-CAI Combustion Transitions

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ABSTRACT

This work was concerned with use of two-stage cam profile switching to transition between SI and CAI combustion in a multi-cylinder direct fuel injection research engine. In order to achieve robust combustion mode changes, it proved necessary to switch the inlet and exhaust bank of tappets independently of one another. Practical issues addressed to improve tappet response included minimising tappet oil circuit dead volumes and reducing the oil pressure difference before and after a switch. When switching from SI to CAI combustion, it was possible to avoid misfire and operate the engine in a mixed-mode form of combustion. In addition, it was demonstrated that supplementary external EGR could be used to minimise transient peak knocking pressures during such transitions. Differences in overall engine noise levels during SI and CAI have also been qualified and some possible solutions are discussed.