NUMERICAL INVESTIGATIONS ON THE PORT FLOW FIELD OF A TWO-STROKE POPPET VALVE ENGINE

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ABSTRACT

This paper describes the model and simulation results of port flow field investigations on a two-stroke poppet valve engine. Higher power to weight ratio has been the advantage of a two-stroke engine over the four-stroke engine. However, poor emissions have plagued two-stroke ported design which is the main design mass produced for small engines. By employing poppet valve configuration, the gas exchange performance, hence the emissions can be improved. In order to verify this, two-dimensional (2D) and three-dimensional models of the two-stroke poppet valve engine are developed to illustrate the port flow field with the proposed valve timings obtained from the one-dimensional numerical analysis. Several design changes on the cylinder are proposed and investigated through the simulation. Further insight into the fluid mechanics of the flow into the engine can be provided by examining the in-cylinder velocity flow fields. The 2D simulation results have shown that by having a shroud on the inlet valve, the short-circuiting can be minimised without any modification on the cylinder head. Further, the 3D simulation results have shown sufficient swirl occurs in the cylinder but the tumble flow is not apparent.

Keywords: Two-stroke; poppet valve; port flow simulation; Computational Fluid Dynamics (CFD).

INTRODUCTION

Rapid development in engine downsizing has been observed globally due to the successful market introduction by key automotive manufacturers as well as significant interest and acceptance by the consumers. Further, the consumer perceptions towards low capacity engine, which conventionally reflects the low engine power, has now changed as engine boosting has been adopted for small gasoline engine [1]. This can be seen as an opportunity for further research in internal combustion technologies for light vehicle applications. One of such technologies is the two-stroke engine, which has always been the suitable candidate due to its higher power to weight ratio compare to the four-stroke engine. However, this technology is not without a challenge. Among