Abstract:

Inlet port design has a great influence on swirl generation inside the engine cylinder. In this paper, two helical inlet ports having the same helix design were suggested. The first has an upper entrance and the second has a side entrance. With the two ports, shrouded inlet valves having different conditions of shroud and orientation angles were used. Four shroud angles were used; they are 90°, 120°, 150°, and 180°. Also, four orientation angles were used; they are 0°, 30°, 60°, and 90°. 3D simulation model using the sst k-ω model was used for predicting the air flow characteristics through the inlet port and the engine cylinder in both intake and compression strokes. The results showed that the side entrance port produces swirl ratio higher that of the upper entrance port by about 3.5% while the volumetric efficiency is approximately the same for both ports. For both the ports, increasing the valve shroud angle increases the swirl ratio and reduces the volumetric efficiency. The maximum increments of swirl ratio relative to the ordinary valve case occur at valve conditions of 30°-150°, 00-180°, and 30°-180°. At these valve conditions, the swirl ratio values are 6.38, 6.72, and 6.95 at IVC with percentage increments of 69.2%, 78.2%, and 84.4%, respectively. The corresponding values of the volumetric efficiency are 93.6, 92.5, and 91.2, respectively with percentage decrements of 2.84%, 4%, and 5.7%, respectively.

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