Abstract

On the performance of perforated plate with optimized hole geometry

Perforated plates have many advantages compared to other differential type flow meters. Their permanent pressure loss could be lower than that of the standard orifice plates but significantly higher than that of the flow nozzles and the venturi meters. This high permanent pressure loss increases the energy consumption and hence the cost of flow metering. Therefore, the present study aims at minimizing the permanent pressure loss of perforated plates by optimizing their hole geometry. A convergent–divergent hole geometry is proposed for use with perforated plates. This geometry was numerically investigated and optimized by solving the Reynolds Averaged Navier–Stocks Equation (RANS) at different hole geometries. Numerical results show that the optimized convergent–divergent hole geometry reduces the permanent pressure loss by 51.7% at Reynolds number Re=3.5×104. The discharge coefficient of the optimized perforated plate is higher than that of the flow nozzle and comparable to that of the venturi meter. Moreover, a significant improvement of the cavitation number was recorded for the perforated plate with optimized convergent–divergent hole geometry.