# Study of flow energy merger of hybrid pneumatic power system


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**ABSTRACT**

Social problems such as environmental pollution and limited crude oil resources are great challenges that have become major concerns, so scientists and researchers are investing significant time and effort in developing new technologies that can be applied in the automobile industry. The focus of these technologies is the realization of zero-pollution and green vehicles, including the creation of hybrid electric vehicles (HEVs), electric vehicles (EVs), fuel cell vehicles (FCVs). HEV, EV, and FCV technologies have been further developed and are now in limited use. However, these vehicles still have limitations. In order to solve the above limitations, a hybrid pneumatic power system (HPPS) is proposed in this study. This system stores the flow energy instead of a battery ’ s electrochemical energy; moreover, it can recycle the exhaust-gas energy of an internal combustion engine (ICE) and make the ICE operate at its sweet spot of maximum efficiency. Therefore, it can be considered as an effective solution to significantly increase system energy efficiency and effectively improve exhaust emissions. This study focuses mainly on achieving two objectives. First, it experimentally investigates the operating capabilities of the HPPS, effects of the Pair, and contraction of section area (CSA) at the merging region on the flow energy merger in the system. Second, this study also investigates the effects of the dimensions of merger pipe, compressed airflow rate, and CSA on the exhaust-gas energy recycling, and determines the optimum dimensions and suitable adjustment of the CSA for the best merging process by using three-dimensional simulation of the computational fluid dynamic (CFD). The experiments and simulation were performed on a HPPS that used an innovative energy merger pipe where configuration and dimensions were suitably designed, while CSA was adjusted for the change in Pair and compressed airflow rate. The obtained results indicate that the exhaust-gas energy recycling and merger flow energy in the HPPS not only strongly depend on configuration and dimensions of the energy merger pipe but also are significantly influenced by CSA adjustment for the change in Pair and compressed airflow rate. These study results will be valuable bases and useful to research and design the energy merger pipe and control system of the HPPS.



Keywords : Hybrid pneumatic power system ; Exhaust-gas energy ; Energy merger pipe ; Flow energy merger


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