World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:10, No:09, 2016

Enhancing Engineering Students Educational Experience: Studying Hydrostatic Pumps Association System in Fluid Mechanics Laboratories

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Abstract : Laboratory classes in Engineering courses are essential for students to be able to integrate theory with practical reality, by handling equipment and observing experiments. In the researches of physical phenomena, students can learn about the complexities of science. Over the past years, universities in developing countries have been reducing the course load of engineering courses, in accordance with cutting cost agendas. Quality education is the object of study for researchers and requires educators and educational administrators able to demonstrate that the institutions are able to provide great learning opportunities at reasonable costs. Didactic test benches are indispensable equipment in educational activities related to turbo hydraulic pumps and pumping facilities study, which have a high cost and require long class time due to measurements and equipment adjustment time. In order to overcome the aforementioned obstacles, aligned with the professional objectives of an engineer, GruPEFE - UNIP (Research Group in Physics Education for Engineering - Universidade Paulista) has developed a multi-purpose stand for the discipline of fluid mechanics which allows the study of velocity and flow meters, loads losses and pump association. In this work, results obtained by the association in series and in parallel of hydraulic pumps will be presented and discussed, mainly analyzing the repeatability of experimental procedures and their agreement with the theory. For the association in series two identical pumps were used, consisting of the connection of the discharge of a pump to the suction of the next one, allowing the fluid to receive the power of all machines in the association. The characteristic curve of the set is obtained from the curves of each of the pumps, by adding the heads corresponding to the same flow rates. The same pumps were associated in parallel. In this association, the discharge piping is common to the two machines together. The characteristic curve of the set was obtained by adding to each value of H (head height), the flow rates of each pump. For the tests, the input and output pressure of each pump were measured. For each set there were three sets of measurements, varying the flow rate in range from 6.0 to 8.5 m 3 / h. For the two associations, the results showed an excellent repeatability with variations of less than 10% between sets of measurements and also a good agreement with the theory. This variation agrees with the instrumental uncertainty. Thus, the results validate the use of the fluids bench designed for didactic purposes. As a future work, a digital acquisition system is being developed, using differential sensors of extremely low pressures (2 to 2000 Pa approximately) for the microcontroller Arduino.

Keywords : engineering education, fluid mechanics, hydrostatic pumps association, multi-purpose stand
Conference Title : ICGEE 2016 : International Conference on Global Engineering Education
Conference Location : London, United Kingdom
Conference Dates : September 29-30, 2016