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Investigations on Flow Dynamics of A Proton Exchange Membrane Fuel Cell

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Abstract : Most of the world's energy requirements are presently addressed by burning fossil fuels in low efficiency thermal processes, on its consequence atmospheric pollution, global warming, green house effect etc, are the objects of many debates and needs proper restriction of pollutant emissions to protect the environment. Transportation represents a significant portion of world energy consumption and contributes considerably to the atmospheric pollution. Although electrical vehicles emits lower amount of toxic gases, however their increasing number results in growing level of pollution from transportation sources.Fuel cell is the most promising alternative power sources for stationary and mobile applications. Fuel cell is electro-chemical device that operates at high-energy conversion efficiency, high power density, low emissions and low operating temperature. Fuel cell operates on the principle of conversion of chemical energy directly into electricity and heat, rather than oxidize (burn) a fuel. In most, the source of the fuel's chemical energy is hydrogen. Generally such as hydrogen Fuel cell comprises an anode, a cathode and electrolyte material sandwiched in between two thin electrodes (porous anode and cathode). In simple hydrogen-oxygen fuel cell, the hydrogen passes over the anode and oxygen passes over the cathode .The fuel catalytically dissociates in to ions and electrons. The electrons go through an external circuit to serve an electric load while the ions move through the electrolyte toward the oppositely charged electrode. At the cathode, ions combine to create by-products, primarily water. Depending on the input fuel and electrolyte, different chemical reactions will occur. Among various types of fuel cells Polymer electrolyte membrane fuel cells (PEMFC) are highly efficient and operate at moderate temperature conditions. The operating parameters play a vital role in the performance of fuel cell. This projects deals with the effect of flow dynamics of a proton exchange membrane fuel cell. The effect of the pressure losses in the flow distributor plate of the fuel cell depends on the Reynolds number and geometric parameters of the flow channels. PEMFC performance is experimentally studied for laminar flow through bends of 180° and serpentine channels of a typical fuel cell configuration. The effect of the geometric parameters and Reynolds number on the flow pattern and the pressure loss characteristics are investigated. A three-regime correlation will be developed for the excess bend loss coefficient as a function of the factors such as Reynolds number, aspect ratios, curvature ratios and spacer lengths between the channels.