Worldwide demand for power has been growing exponentially, but its production is causing undeniably negative effects; environmental regulations are changing and becoming stricter. The desire for economical but environmentally friendly engines is driving toward alternative methods to produce power. “The Wave Disc Engine” is a proposed technology to surpass these requirements. The reduction of mechanical parts in the drive train compared with an IC engine and the use of CNG or any other renewable fuel gas make this WDE an attractive technology to generate power. This new engine concept is a radial rotor in which the typical processes of an Internal Combustion Engine (Compression, Combustion, and Expansion) are realized. Several prototypes were built between 2011 and 2013. For torque production, the unsteady expansion process of outflowing combusted gases is harnessed. This is a new engine concept with incipient research, investigating the mechanism to generate power under unsteady conditions; this research work focuses on determining factors, which contribute to produce torque in radial rotor channels. The study initially focuses on the influence of channel parameters: width, height and length; and concludes that channel length, pressure, and suction side areas all influence torque generation. Both length and wall areas combine to raise the efficiency and power generated.

The unsteady expansion of the gas transfers energy from the fluid to the walls, so an alternative approach was used to evaluate the performance. The Exergetic efficiency produced results for the channel geometry and conditions tested in the range of 31 to 67%. Also, this approach revealed between 82 to 89% of the exergy initially contained in the channel still has the potential to be converted into torque in continuing stages.

In addition, the unsteady expansion from the energy analysis shows great potential to produce power, and this conversion can be achieved through the increase of expansion time. The impact on the tangential force by the parameters: beta angle, area of influence, and static pressure on pressure and suction wall of a constant cross-section channel, are investigated. The first two parameters change inversely but when combined show similar values at each pressure and suction wall location. Also, most of the generated torque was found in zones near the trailing edge of the channel.

The final section deals with torque generation composed of two terms: the change of the angular momentum of the fluid within and the rate of outflow of the angular momentum at the outlet of the channel. This consideration produces two components in torque generation called unsteady and outlet boundary effects. These effects show the gas expansion process benefits when channel opens quickly. Therefore, the increase of rotational velocity approximates the
quick opening benefiting the unsteady effects, but reduces the positive results of the outlet boundary effects. Centrifugal and pressure gradient forces influence in these results.

*Persons with disabilities please contact the Mechanical Engineering office at 517-355-5131 to request accommodations.*