

Abstract Submitted
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Hairpin Vortex Regeneration Threshold¹ DANIEL SABATINO, Lafayette College, RIJAN MAHARJAN, Yale University — A free surface water channel is used to study hairpin vortex formation created by fluid injection through a narrow slot into a laminar boundary layer. Particle image velocimetry is used to calculate the circulation of the primary hairpin vortex head which is found to monotonically decrease in strength with downstream distance. When a secondary hairpin vortex is formed upstream of the primary vortex, the circulation strength of the head is comparable to the strength of the primary head at the time of regeneration. However, the legs of the primary vortex strengthen up to the moment the secondary hairpin is generated. Although the peak circulation in the legs is not directly correlated to the strength of the original elongated ring vortex, when the circulation is scaled with the injection momentum ratio it is linearly related to scaled injection time. It is proposed that the injection momentum ratio and nondimensionalized injection time based on the wall normal penetration time can be used to identify threshold conditions which produce a secondary vortex.

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