ABDULAFEEZ ADEBIYI, AMANDA CATHRENO and V'YACHESLAV AKKERMAN, Dept. of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, 26506. Different Trends of Premixed Flame Propagation in Obstructed Channels with both Ends Open.

Premixed flames accelerate extremely fast and may even trigger a detonation when propagating in semi-open obstructed channels (here one end of a channel is closed; the flame is ignited at the closed end and propagates towards the open one). However, industrial pipes often have both ends open, with a flame ignited at one the ends. The present work is devoted to this configuration. Specifically, premixed flame propagation through a comb-shaped array of obstacles, in-built in a two-dimensional (2D) channel of half-width R with both ends open, is studied by solving fully-compressible hydrodynamic and combustion equations with Arrhenius chemical kinetics. The channels of half-widths R/L_f = 12, 24, 36 (L_f is the thermal flame thickness) are considered, with various blockage ratios, α = 1/3, 1/2, 2/3, for each R. It is found that in the relatively narrow channels, R/L_f =12 and 24, the instantaneous total burning rate oscillates with time for all α considered, with the oscillation period and amplitude varying with R and α. In fact, such an oscillating regime resembles that observed previously in *unobstructed* channels with both ends open. The oscillations can potentially be treated as fluctuations around a quasi-steady solution. In contrast, in a wider channel, R/L_f = 36, the oscillations are terminated soon, followed by flame acceleration, which is weaker (though similar) to that in semi-open channels. The results support the recent experiment, modelling and theory yielding steady or quasi-steady flame propagation prior to the onset of flame acceleration in obstructed pipes with both ends open.

Acknowledgements: This work is supported by the National Science Foundation (NSF) through the CAREER Award #1554254 (V.A.)