DESIGN AND DEVELOPMENT OF A RESONANCE IGNITION SYSTEM USING GASEOUS PROPELLANTS

Master's Thesis Defense in Mechanical Engineering

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Committee Members: Dr. Patrick Lemieux (Chair), Dr. Hans Mayer, and Dr. Kim Schollenberger

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Zoom Meeting ID: 450 383 1616

Liquid rocket ignition systems are a critical aspect of engine design. Today, spark-torch ignition systems are prevalent in rocket engines for their reliability and reusability, but they require electrical hardware that increases system complexity and mass. Resonance ignition offers an alternative. Rather than using an electrical discharge, a resonance igniter initiates combustion by heating propellants to their autoignition temperature through rapid cyclical compression waves/shocks. The device consists solely of mechanical components, offering the potential to simplify and lighten rocket engine ignition systems. Furthermore, the resonance igniter can endure many cycles, making it attractive for deep-space or long-duration missions that require numerous engine restarts. Because the technology is still in an early stage of development, further characterization is needed. This work presents the design, implementation, and experimental evaluation of a laboratory resonance ignition system.

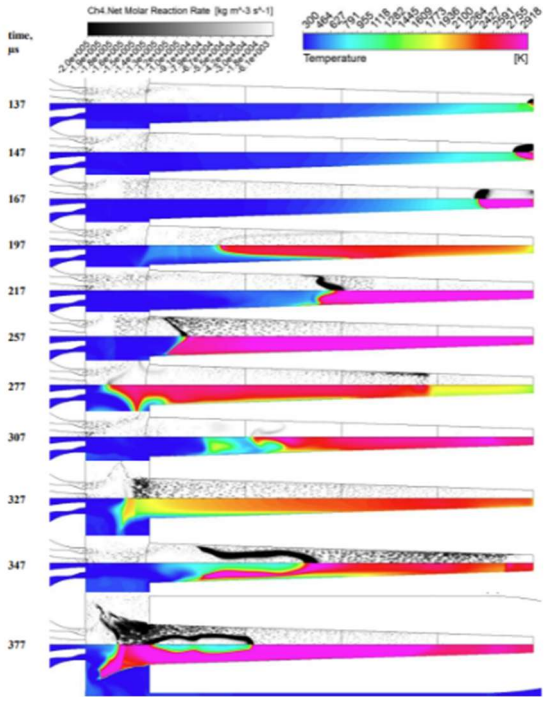

Figure 1: *Spatiotemporal simulation of a resonance ignition and flame propagation (Bauer & Haidn, 2016).*

Figure 2: *Hardware designed and tested in this work.*