This study describes three-dimensional (3D) quantitative visualization of density field in a supersonic flow around a cone spike. A measurement of the density gradient is conducted within a supersonic wind tunnel facility at the Propulsion and Energy Research Laboratory at the University of Central Florida utilizing Structured Light-Field Focusing Schlieren (SLLF). In conventional schlieren and Shadowgraph techniques, it is widely known that a complicated optical system is needed and yet visualizable area depends on an effective diameter of lenses and mirrors. Unlike these techniques, SLLF is yet one of the same family as schlieren photography, it is capable of non-intrusive turbulent flow measurement with relatively low cost and easy-to-setup instruments. In this technique, cross sectional area in the flow field that are parallel to flows can be observed while other schlieren methods measure density gradients in line-of-sight, meaning that it measures integrated density distribution caused by discontinuous flow parameters. In order to reconstruct 3D model of shock structure, two-dimensional (2D) images are pictured to process in MATLAB. The ultimate goal of this study is to introduce a novel technique of SLLF and quantitative 3D shock structures generated around a cone spike to reveal the interaction between free-stream flow and the high-pressure region.

Major: Aerospace Engineering

Educational Career:
Bachelor’s of Mechanical Engineering, BS, 2015, Yokohama National University

Committee in Charge:
Kareem Ahmed, Chair, MAE
Samik Bhattacharya, Mechanical and Aerospace Engineering
Tuhin Das, Mechanical and Aerospace Engineering

Approved for distribution by Kareem Ahmed, Committee Chair, on February 23, 2018.

The public is welcome to attend.