ICLASS – 2009-087
An experimental study of the atomization of a liquid film submitted to an external forcing

Madjid Boukra*, A. Cartellier, E. Ducasse, P. Gajan, M. Lalo,
T. Noel and A. Strzelecki
Aerodynamics and Energetics Modeling Department
The French Aerospace Lab
2, Edouard belin, 31055 Toulouse, France

Abstract

Atomization of liquids in a spray is an important process in many industrial applications and particularly in the aero-engine field. The objective of this study is to validate a new concept of injectors which couples the shearing effects with the principle of ultrasonic atomization. The latter consists of using piezoelectric actuators to generate the oscillations of a wall in contact with the liquid film. This excitation (frequency: 1 to 50 kHz) perpendicular to the liquid film surface creates Faraday instabilities at the liquid/air interface. Amplitudes higher than a defined threshold value induce the break-up of ligaments and the formation of fine droplets. As result, Faraday's instabilities are generated at the interface leading to the production of droplets which size and acceleration threshold are dependant on the excitation parameters (oscillation frequency and amplitude) and liquid properties (density and surface tension). In this paper, laws deduced from theories or experiments for thick steady fluids are compared to experimental results obtained with a thin liquid film (300 μm and 1 mm) flowing on a wall and sheared by an external high speed air flow up to 100 m/s.

Key words: Liquid Atomization, Airblast injectors, Ultrasonic atomizers, Shear instabilities, Faraday instabilities.

*Corresponding Author, madjid.boukra@onecert.fr