

## **Experimental and Numerical Investigation of a Pressure Swirl Atomizer**

B. Sumer<sup>\*</sup>, N. Erkan<sup>\*</sup>, O. Uzol<sup>+</sup>, I.H.Tuncer<sup>+</sup>

<sup>\*</sup> Defense Industries Research and Development Institute, Scientific and Technological Research Council of Turkey (TÜBİTAK-SAGE), Ankara, Turkey.

<sup>+</sup>Department of Aerospace Engineering, Middle East Technical University, Ankara, Turkey.

bulent.sumer@tubitak.gov.tr, nejdeterkan@gmail.com, uzol@metu.edu.tr,

tuncer@ae.metu.edu.tr

### **Abstract**

The flow structure inside a pressure swirl atomizer is investigated using high-speed shadowgraphy techniques and computational fluid dynamics tools. The hollow cone spray properties are detected using Phase Doppler Particle Analyzer. The experimental and numerical results are analyzed and compared. The aircore inside the pressure swirl atomizer is visualized at high temporal and spatial resolutions with the high-speed shadowgraphy system. The images captured are analyzed quantitatively with a developed image processing tool. The analyses reveal strong fluctuations of the aircore diameter. Three dimensional and two dimensional axisymmetric-swirl models are used for the numerical study performed with ANSYS-FLUENT software. Unsteady, two phase laminar flows are computed using the volume of fluid method. Three-dimensional and two-dimensional numerical simulations also predict strong oscillations of aircore diameter near the base of swirl chamber. In addition, a two-component Phase Doppler Particle Analyzer is employed to investigate the spray properties.

---

---

<sup>\*</sup> Corresponding author: bulent.sumer@tubitak.gov.tr