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NUMERICAL INVESTIGATIONS ON ATOMIZATION OF ELECTROHYDRODYNAMIC LIQUID JETS

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ClusterDEM
Multiphysics Flow Research

NUMERICAL SIMULATIONS OF TRANSIENT ELECTROHYDRODYNAMICS

Electrohydrodynamic (EHD) jets are widely utilized in a variety of applications, including drug delivery, fuel injection, micro-propulsion and spray coating. This study endeavors to integrate **fully three dimensional (3D) computational fluid dynamics (CFD)** to gain a more profound understanding of the deposition of electrohydrodynamic liquid droplets.

The atomization process is complex, involving numerous variables. To comprehend the fundamentals of the **Jet atomization** and **Liquid Depoition** a single **Taylor Cone Jet** is employed. The simulations conducted have proven that ***3D simulations are indispensable in deepening our understanding of the complex processes involved in jet deposition and spray atomization*** (Cândido & Páscoa, 2023).

ELECTROHYDRODYNAMIC GOVERNING EQUATIONS

Electrohydrodynamics relates the dynamics of fluid flows in the presence of electric fields. In this study, we coupled the **Navier-Stokes equations** for hydrodynamics with the **Maxwell's equations** for electrostatics.

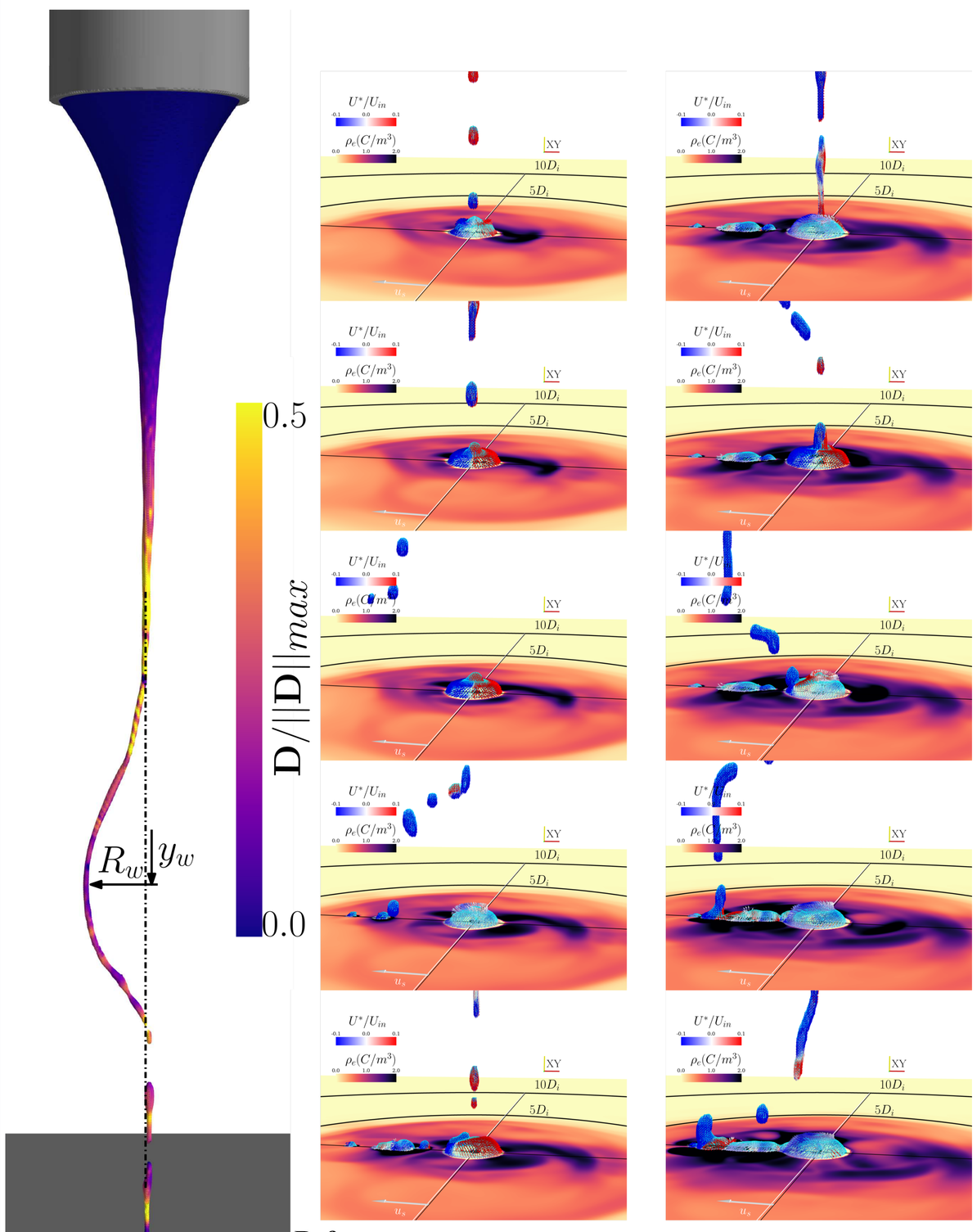
$$\nabla \cdot \vec{u} = 0,$$

$$\frac{\partial}{\partial t}(\rho\vec{u}) + \nabla \cdot (\rho\vec{u}\vec{u}) = -\nabla p + \nabla \cdot \vec{\vec{\tau}} + \rho\vec{g} + \vec{F}_\sigma + \vec{F}_e$$

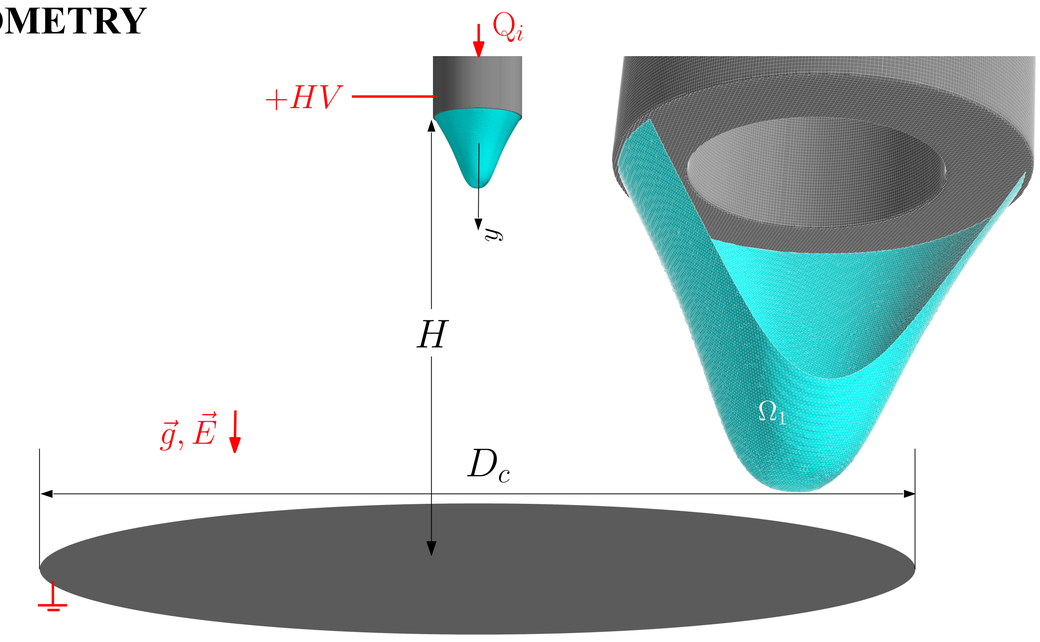
$$\nabla \cdot \left(\varepsilon\vec{\mathrm{E}}\right) = \rho_e,$$

$$\frac{\partial}{\partial t}\rho_e + \nabla \cdot (\rho_e\vec{u}) + \nabla \cdot (\sigma\vec{E}) = 0$$

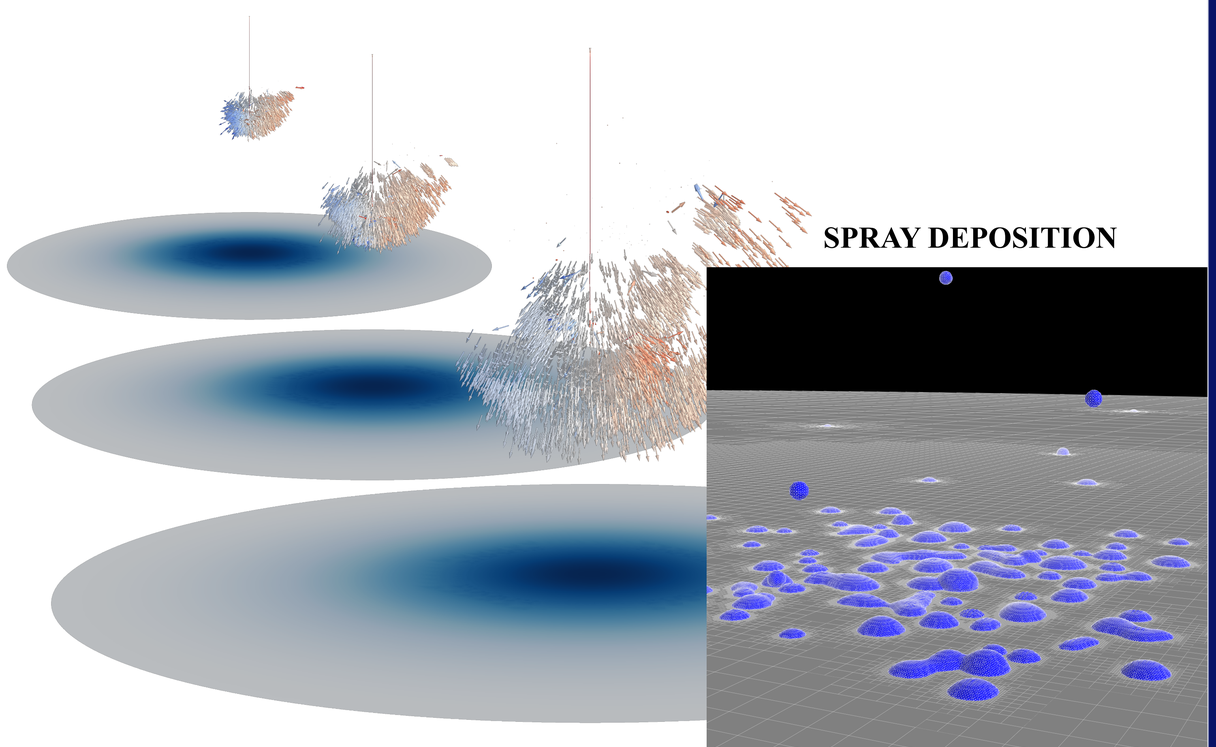
WHIPPING EFFECT AND DEPOSITION



GEOMETRY



SPRAY FORMATION



SPRAY DEPOSITION

References

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