

How do travelling capillary waves entrain air?

Description

When an oil drop falls on a water pool, a cavity is formed (Figure 1(1.75 ms – 8.5 ms)). Oil spreads on the top of this cavity (Figure 1(6.5 ms – 8.5 ms)). In a recent publication from our group (Jain et al., 2019), we observed that capillary waves travelling on water-oil and oil-air interface interacts with each-other to entrain air bubbles (Figure 1(18.5 ms – 45.5 ms)). This air bubble rests inside an oil drop, which is surrounded by water pool (Figure 1(45.4 ms)). For further details of the process, please visit: <https://www.youtube.com/watch?v=n8Ou-SDNkAg> or refer to Jain et al. (2019).

We would like to understand the mechanism of this entainment of air bubble. In particular, we will focus on the propagation of capillary waves on different interfaces to study the entrainment process. In our simulation, we will use an in-house developed read-to-use code to solve the problem of the oil drop impact on water pool. We will focus on the hydrodynamics of the process. We will use a first of its kind three-phase contact line model for these simulation. For details regarding the three-phase contact line model, please refer to <https://youtu.be/ozrnYe8u1HA>.

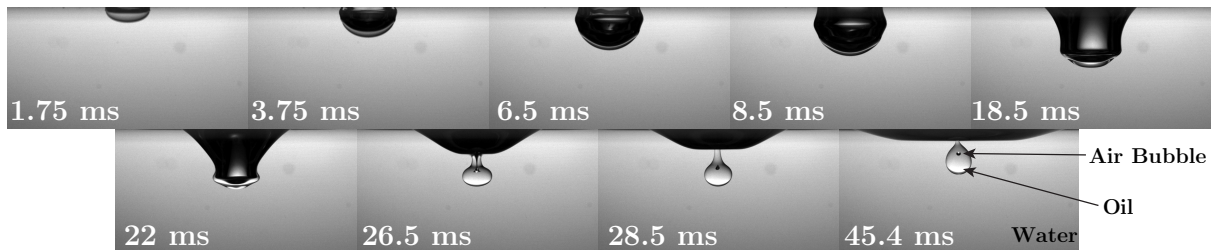


Figure 1: Temporal sequence of the air-entrainment process.

What you will do and what you will learn?

In the Physics of Fluids group, we are looking for enthusiastic students.

1. You will learn about fundamental fluid dynamics and capillary waves propagation.
2. You will get hands-on experience with Computational Fluid Dynamics (CFD).
3. You will learn how to do basic and advance data analysis.
4. You will work closely with experimentalists to understand the process.

If you have any questions, fell free to contact [Vatsal](#) or [Utkarsh](#) (details below).

Supervision	E-mail	Office
Vatsal Sanjay	v.sanjay@utwente.nl	Meander 246B
Utkarsh Jain	u.jain@utwente.nl	Meander 247
Prof. Devaraj van der Meer	d.vandermeer@utwente.nl	Meander 259
Prof. Detlef Lohse	d.lohse@utwente.nl	Meander 261

References

Jain, Utkarsh, Maziyar Jalaal, Detlef Lohse, and Devaraj Van Der Meer (2019). “Deep pool water-impacts of viscous oil droplets”. In: *Soft matter*.