KONINKLIJKE
HOLLANDSCHE MAATSCHAPPIJ
DER WETENSCHAPPEN

**Juryrapport**
**KHMW Jong Talent Afstudeerprijs voor Werktuigbouw en Materiaalkunde 2025**

**Ir. Jnandeep Talukdar, Universiteit Twente**
*Singularities with Surfactants*

For the KHMW Young Talent Graduation Award for Mechanical Engineering and Materials Science 2025, nine candidates were nominated by their supervisors or graduation professors. The jury is highly impressed by the exceptional quality of the nominated candidates, all of whom graduated *cum laude* from Dutch engineering programs. The jury is convinced that these talented engineers stand at the outset of promising careers.

The jury's final preference concerns work addressing a fundamental question in fluid mechanics: how two liquid droplets behave upon contact in the presence of surface-active agents (surfactants). Such processes play a crucial role in emulsions, inkjet printing, and oil spill mitigation.

This groundbreaking work, entitled *Singularities with Surfactants*, was carried out by Ir. Jnandeep Talukdar. He describes the problem using three dimensionless parameters: 1st the variation in surface tension induced by the surfactant, 2nd the ratio between fluid transport and diffusion and 3rd the initial contact angle.

The jury is particularly impressed that Jnandeep, with scientific depth, theoretical originality, and mathematical precision, has succeeded in constructing an accurate prediction of droplet behaviour — entirely without free parameters.

He demonstrates that surfactants decisively influence, immediately after first contact, both the velocity and direction of motion of two droplets. He further shows that above a certain concentration, coalescence is avoided — a phenomenon that had been observed before but never satisfactorily explained. When fluid transport dominates, new *singular fluid waves* can emerge, comparable to observations in compressible fluids, even though the fluid under consideration is incompressible.

The graduation committee was evidently already highly impressed by his work, as reflected in the perfect grade of ten. This study opens broad perspectives for further research, for instance on lubricants. Moreover, his simulation code is already publicly available and can be used to improve fluids employed in inkjet printing or surfactants used in combating oil spills.

*Prof. dr. ir. A. (Albert) van den Berg, universiteitshoogleraar Universiteit Twente*
*Prof. dr. E.H. (Ekkes) Brück, hoogleraar fundamentele aspecten van materialen en energie Technische Universiteit Delft*

De jury vergaderde op 16 oktober 2025 via Zoom onder leiding van KHMW-maatschappelijk lid jhr. mr. Th.S. (Theo) Röell. Tevens was ter vergadering aanwezig prof. dr. A.P. (Ad) IJzerman, bestuurslid en secretaris natuur- en medische wetenschappen KHMW.