Analysis of Surface Tension and Buoyancy Acting on Horizontally Floating Cylinders

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On the gas-liquid interface, an object heavier than the liquid can float due to the surface tension and buoyancy acting on the floating object. According to Archimedes' principle, objects fully or partially immersed in liquid are supported by buoyancy equal to the weight of displaced liquid. This idea was further developed by Galileo who extended Archimedes' principle to surface tension, and then by Keller who mathematically proved that volume of meniscus is equal to the surface tension acting at the gas-liquid interface. However, conventional models of floating objects were constructed from the conceptual study and were accepted without empirical observation due to the lack of technology at the time. In this study, conventional models on floating objects are empirically tested using horizontally floating cylinders with different density. By comparing conventional models with empirical data, surface tension and buoyancy acting on floating cylinders are analyzed. As the result, errors and misconception on conventional models were analyzed and new force balance model of floating objects was constructed.