Get Wet: Ultrasonic Standing Waves

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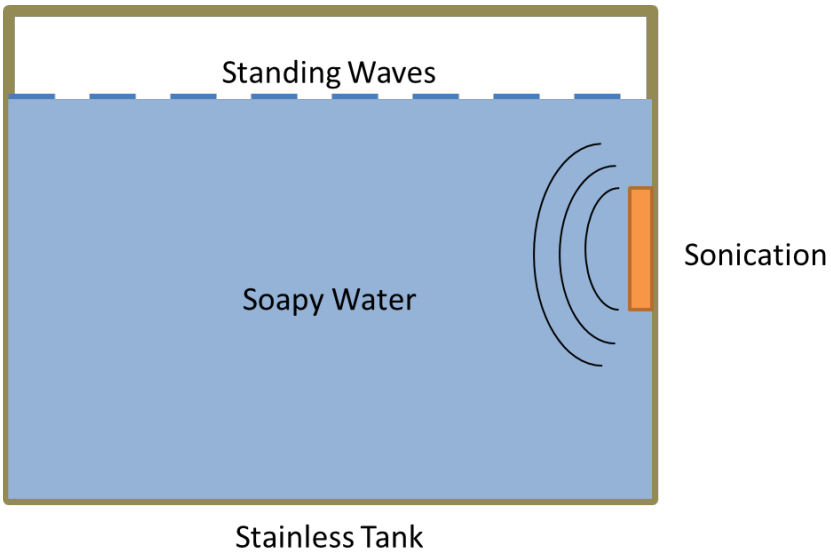
Liquid surfaces normally lay flat, completely submitting to gravity, but give them a little vibrational energy and stationary ripples will appear. In this example an ultrasonic cleaning machine was used to excite soapy water. Ultrasonic cleaners use vibrations at 20-400 kHz to create cavitation bubbles on a part's surface. These bubbles implode against the surface with large changes in pressure to scrub contaminants from submerged parts. Along the surface, interference patterns appear from pressure waves bouncing off the walls. These waves combine constructively at the peaks and destructively in the troughs. The pattern formed by gravitational and hydrostatic forces finding equilibrium. Energy is constantly add by the sonication and dissipated by viscous forces. A stationary rippled surface it the result.



There was no special visualization technique used to get this photograph. The camera's flash reflected nicely off all the surface of the ripples. The line bisecting the lighter upper half from the darker bottom half is from light reflecting off the stainless steel sides. The digital Nikon Coolpix L100 camera used does not allow for manual adjustments, so the following parameters are from the auto focus: f/3.8 F-stop, 1/30sec exposure time, 400 ISO speed, 7 mm focal length, 3.6 aperture, and compulsory flash. Post processing in Photoshop consisted of cropping and contrast adjustments. The object to lens distance was two feet and about 40 degrees to level. Top to bottom the image covers 15 inches of surface and the peak amplitude was approximated at 3/8 inch. The tank was 24 by 30 by 30 inches deep. The sonication was at 30% power.

The image reveals a busy interference pattern that still radiates from a peak position. Artistically I appreciate the light and dark divide crossed by messy waves, both sides containing orange elements. It comments on duality, mixtures, and finding values. The more I look at the image, the less I want to

change. It could be sharper, more uniform, without bubbles, the waves in the corners could be seen better, but I wouldn't change it. In future experiments it would be interesting to use a non-rectangular tank. To what extent can the shape be controlled?