Liquid Stream Hits Rough Surfaces - Showing an Extraordinary and Stable Wave Pattern

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A steady stream of a certain liquid, hitting a rough surface (e.g. a wooden board) perpendicularly, yields a surprising result. A water wall encloses a regular wave pattern centered on the water stream. The objective of our project is to both explain the pattern's emergence and describe its shape mathematically. Ultimately, we are able to explain the appearance of the pattern. Starting from simple assumptions about the flow and the Mach cone, we derive a mathematical model that describes the shape accurately. This mathematical model is also validated experimentally. The surprising result is that all pattern segments are semi-circles. We can show that this structure is stable for different viscosities, flow rates and protrusion densities of the considered surface. Dependence of the size of the pattern on various parameters is considered as well.

Awards Won:
Third Award of $1,000