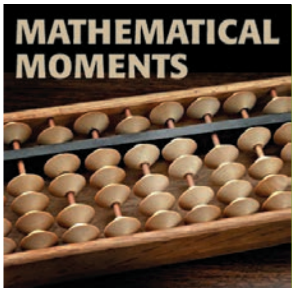

Working Up a Lather

Bubbles, of little matter both in weight and presumed practical use, are the building blocks of foam. So that actually makes them crucial in many applications ranging from the padding inside bicycle helmets to fire retardants. And as anyone who has observed foam knows, bubbles come in various sizes, they grow, form clusters (as below), and burst—all of which has made describing foam quite difficult. Mathematicians recently successfully modeled clusters of hundreds of bubbles for the first time by treating different aspects of their interactions separately, such as the flow of fluid between connected bubbles. The key to their model was solving sets of linked partial differential equations, which allowed researchers to break up the problem into different components while making sure that the components could still be coupled together consistently.

A round soap bubble minimizes surface area: a sphere is the least-area way to enclose a given volume of air. One long-unresolved question, known as the "double-bubble conjecture," asked if two bubbles that meet in the usual way provide a least-area way to enclose and separate two equal volumes of air. The proof that they do offers an illustration of patterns in some modern mathematics research: It involved computers, it was the work of many people, including undergraduates, and the research didn't end there. What about three or more bubbles? Shapes enclosing unequal volumes? Or those in higher dimensions? …If only the answers would just pop up.

For More Information: "Multiscale Modeling of Membrane Rearrangement, Drainage, and Rupture in Evolving Foams," Robert I. Saye and James A. Sethian, *Science*, May 10, 2013.

Image: James Sethian and Robert Saye, UC Berkeley.

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