STUDENT WORK SECTION

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The following student article is a product of a senior thesis project in mathematics at Bates College. The work was supervised by Prof. Bonnie Shulman.

PATTERNS IN THE SAND: A MATHEMATICAL EXPLORATION OF CHLADNI PATTERNS

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Chladni Patterns are formed when sand settles at the nodes of two dimensional standing waves, excited on a metallic plate which is driven at a resonant frequency. By considering a two-dimensional rectangular membrane with fixed boundary and constant density as an idealized model of the metal plate, a formula for predicting the Chladni Patterns that will form at certain frequencies can be found. In addition to mathematically exploring these mysterious patterns, I have created my own "Chladni Patterns" in the lab.

The Genesis

"Seeing M. Chladni's experiments during his stay in Paris excited my interest anew. I began studying...desiring to come to appreciate those difficulties that [were] brought to mind." -Sophie Germain

Why is it that when a metallic plate, covered with a fine powder, and is vibrated at certain frequencies, beautiful patterns form in the powder? What can be learned from these wonderful "Chladni Patterns"? These questions have intrigued some of the greatest mathematicians, physicists, and even national leaders: Galileo, Laplace, Legendre, Poisson, Gauss, Chladni, Germain, and Napoleon.