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GRANULAR AND MULTIPHASE FLOWS

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The Granular Science Laboratory

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Mechanical Engineering Center - Room 224

Tapping Dynamics for Column of Particles

Consider a container filled with particles that is tapped periodically at the bottom. By assuming a simple Hertzian interaction force among particles and walls, one can describe the motion of the particles using Newton's 2nd law. The large system of ordinary differential equations obtained is only amenable to rather superficial dynamical analysis. More information can be gleaned from associated approximate partial differential equations (PDEs) describing wave-like behavior in the evolving particle configuration, obtained from either the long-wavelength limit or a method devised by Blackmore, Samulyak and Rosato. The details of this approach are described starting with a one-dimensional column of particles. It is shown how these PDEs provide information on such dynamical properties as density and phenomena such as jamming. Extensions of this approach to two- and three-dimensions are briefly described.

Prof. Blackmore has been a Professor of Mathematical Sciences at NJIT since 1982, has been a Visiting Member of the Courant Institute of Mathematical Sciences on several occasions, and also has been a Visiting Professor at Duke, the University of Connecticut, and the Technical University of Denmark. Previously he taught at the Polytechnic University of New York (now NYU-Poly). While conducting his research in dynamical systems, computational topology, and differential topology, he has also devoted considerable time to collaborative research with scholars in various science and engineering disciplines. His research in fluid dynamics, granular flow dynamics, computer-aided geometric design, mathematical physics, biomathematics, and metrology reflects his interests in applications of mathematics. Prof. Blackmore received his Ph.D. in Mathematics in 1971 from the NYU-Poly. He also earned an M.S. in Mathematics and a B.S. in Aerospace Engineering from the same institution. His research as a graduate student was in the areas of boundary layer theory and the qualitative theory of differential equations. Dr. Blackmore has coauthored two books, co-edited three books, is coauthoring a Springer monograph on integrable (infnite-dimensional) dynamical systems, and has published scores of scientific papers in leading journals, books and conference proceedings. Prof. Blackmore is an associate editor of MRC and serves on the editorial boards of four other scientific journals. He has received research grants from DARPA, NSF, ONR and the NJ Commission on Science and Technology. In addition to his research, for which he received the Harlan Perlis Research Award from NJIT in 1993, he is also devoted to instruction in mathematics and has won awards for his teaching.

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