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Structure and Nonlinear dynamical response of Pinned Lattice systems: Application of the Phase Field Crystal Model to Pinned Lattices MIKKO KARTTUNEN, CRISTIAN ACHIM, Helsinki University of Technology, KEN ELDER, Oakland University, TAPIO ALA-NISSILA, Laboratory of Physics, Helsinki University of Technology, ENZO GRANATO, Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos, SP Brazil, S.C. YING, Department of Physics, Brown University — We present analytic and numerical results for the structure and dynamics of a lattice system in 2D in the presence of a pinning potential. We employ a new approach via the Phase Field Crystal (PFC) model which describes phenomena on atomic length and diffusive time scales. It can be used for modeling elastic and plastic deformation, free surfaces and multiple crystal orientations in non-equilibrium processes, and enables access to time scales much longer than conventional atomic methods. The competition between the length scales associated with the intrinsic ordering and the pinning potential leads to commensurate-incommensurate transitions. The dynamical response of the system in the presence of a driving force has also been studied via the time dependent Landau Ginzberg equation. Dynamically induced phases, mobility thresholds and hysteresis behavior have been observed. We will discuss the application of this model to physical problems such as the I-V characteristics of 2-D vortex lattices and sliding friction in interfaces with boundary lubricants.

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