Elastic depinning transition of superconductor vortices

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We present numerical simulation results for driven vortex lattices in presence of random disorder. The dynamics of vortices is studied for weak disorder. Unlike the strong disorder case where plastic depinning occurs, the weak disorder produces elastic depinning and elastic dynamical regimes in the whole driving force range. It means that all particles depin simultaneously and with the same average velocity, giving rise to static elastically coupled channels wherein vortices are flowing. We investigate the dynamics at the depinning threshold force F_c and show that a second order phase transition $v \sim (F - F_c)^\beta$ for the velocity v occurs at zero temperature. The exponent β is extracted from the critical region of several lattice sizes. Finite temperature results are also analysed and $v \sim T^{1/\delta}$ is observed at the critical force F_c and the critical exponent δ is measured. A scaling analysis is derived from these results.