

Driven Diatomic Frenkel-Kontorova Model: Resonant Steps, Spatiotemporal Dynamics and Dynamical Phase Diagrams

XU Ai-Guo,^{1,2} ZHANG Guang-Cai,³ CHEN Shi-Gang,³ YANG Zhan-Ru¹ and WANG Guang-Rui³

¹ Department of Physics, Beijing Normal University, Beijing 100875, China

² International Center for Material Physics, Academia Sinica, Shenyang 110015, China

³ Institute of Applied Physics and Computational Mathematics, P.O. Box 8009, Beijing 100088, China

(Received: 2000-4-14; Revised: 2000-6-1)

Abstract: The resonant steps, spatiotemporal dynamics and dynamical phase diagrams of the driven diatomic Frenkel-Kontorova model are studied. The complete resonant velocity spectrum which relates only to the winding number is given. The diatomic effects result in each resonant step which is characterized by two integer pairs (k_1, k_2) and (k_1, k_2') . In the high-velocity regime the linear response of v to F is often punctuated by the subharmonic resonances $(k_1 > k_2)$. There are two kinds of nonlinear response regimes in the high-velocity regime. A new physical interpretation to the mean-field treatment is presented. The commensurate and incommensurate structures show similar dynamical behaviors except that the latter lacks depinning transition below the Aubry transition point. The increase of m makes the critical forces increasing, the transitions smoother and the hysteresis thinner.

PACS: 05.70.Ln, 46.10.+z, 64.60.Fr

Key words: Frenkel-Kontorova model, resonant step, dynamical phase diagram

[\[Full text: PDF\]](#)

Close