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Moving breathers in lattices with saturable nonlinearity

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In continuous nonlinear media, as a consequence of the continuous translational invariance, moving localized modes can be initiated at an arbitrary position and with an arbitrary transverse velocity. However, in discrete nonlinear media, the discreteness breaks translational invariance of the corresponding continuous system. As a consequence, moving discrete localized modes can be created only at some positions in the lattice and with transverse velocities within some defined intervals. It is associated with the creation of the effective energy barrier to the transverse localized mode motion across the lattice [1]. Particularity of the systems with saturable nonlinearity, in comparison to the system with cubic nonlinearity, is the cascade mechanism of the amplitude saturation which can support the existence of localized modes with high power [2, 3]. For particular power the stationary localized mode of the soliton type centered on lattice element, or centered between two neighboring lattice elements, i.e. on-site or inter-site mode, respectively, is obtained numerically. The stability to the longitudinal perturbation of both the on-site and inter-site bright solitons for one particular power is interpreted by the energy minimum principle. Transversely moving localized modes (always of breather type) with high power are obtained only for a few values of the total power and transverse velocity. These transparent parameter values are associated with the transversal intersections of the stable and unstable manifolds of the fixed point in the origin of the map describing the lattice. In other words, the perfect separtix is formed at the map origin what is equivalent to vanishing of the energy barrier to transverse motion of breathers, or recovering of the system integrability [4]. It is shown that this event coincides with the zeros of the grand canonical effective energy barrier [5]. Therefore the ambiguous interpretation of transverse breather motion in the context of the energy difference between the on-site and inter-site modes with the same power can be overcome. Moreover, the breather fusion is clarified as the only collision output in the lattice system in the region of high power, which is not observed in the continuous systems with saturable nonlinearity.

[1] S. Aubry, *Physica D* **216**, 1 (2006).

[2] M. Stepić, D. Kip, Lj. Hadžievski, A. Maluckov, *Physical Review E* **69**, 066618 (2004).

[3] Lj. Hadžievski, A. Maluckov, M. Stepić, D. Kip, *Physical Review Letters* **93**, 033901 (2004).

[4] A. Maluckov, Lj. Hadžievski, M. Stepić, *Physica D* **216**, 95 (2006).

[5] T. R. O. Melvin, A. R. Champneys, P. G. Kevrekidis and J. Cuevas, preprint (http://www.personal.us.es/jcuevas/english.htm)