סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות **במסגרת הדוקטורט** שתתקיים ביום ה׳ 5.03.2020 (ט׳ באדר, תש״פ), בניין דן קאהן, אודיטוריום 1, 13:45.

מרצה: יצחק שירוקי

מנחה: פרופ׳ אולג גנדלמן

על הנושא:

Front Propagation in Bi-Stable Non-Degenerate Systems

The seminar will be given in Hebrew

תקציר ההרצאה :

We address a classical problem of propagation of transition waves in lattices with a bi-stable non-degenerate on-site potential, in which the driving force is the energetic difference between the wells of the potential. These models have numerous fields of application: motion of dislocations, fracture, phase transitions, magnetic avalanches, switching waves in metamaterials, and many others. A discrete approach here is considered, since it crucially affects the relationship between the velocity of the transition front and the driving force. Most studies in the field deal with solutions which are subsonic travelling kinks. However, among possible solutions one also encounters interesting regimes of supersonic shockwaves and non-travelling waves. These two families of solutions are in the spotlight of the current study.

The first explored problem is that of a chain with a nonlinear coupling, that facilitates the forming of a supersonic shockwave. It is demonstrated that such a transition front possesses unique features which allow a construction of an asymptotic approximation for the front velocity, applicable to arbitrary nonlinear couplings and depends only on general characteristics of the on-site potential. The analytical approach is verified for classical gradient potentials: FPU and Lennard-Jones.

In the opposite limit of slow transitions, one encounters kinks, that are not travelling waves. From general considerations, these should be ubiquitous in bi-stable chains. The reason is that the problem of front propagation may be reformulated as a nonlinear map with a fixed-point solution of travelling kinks. When the parameters of the problem vary, such fixed points lose stability through generic scenarios. For example, one can encounter a quasiperiodic kink propagation, a Feigenbaum cascade of period doublings leading to a chaotic-like propagation pattern and coexistence of solutions. The various scenarios are demonstrated for tri-parabolic and on-site potentials. For the classical Atkinson-Cabrera model with a bi-parabolic on-site potential, the stability threshold is estimated analytically by simple means of linear algebra. The loss of stability in this model occurs through Hopf bifurcation.

בברכה,

פרופ"א מתי סאס

מרכז הסמינרים