Title: **PHASE TRANSITION IN DISCRETE MODELS, COMPATIBILITY AND STILL STATES**

Abstract: We consider a two-dimensional periodic triangular network of unit masses connected by non-linear bi-stable springs. The energy of each spring is piecewise quadratic and has two minima. Therefore, a spring would undergo a reversible phase transition when its elongation reaches a critical value. The objective is to characterize the effective continuum energy as the number of nodes N approaches infinity. The most important feature of the effective energy is its "flat bottom". This means that the effective energy density is zero for all strains inside a certain three-dimensional set in the strain space. The flat bottom occurs because the microscopic discrete model has a large number of deformed states that carry no forces. We call such deformations still states. In the talk, we present a complete characterization of the (macroscopic)"flat bottom" set in terms of the (microscopic) parameters of the network. This is done by constructing a special family of still states whose average strains densely fill the set in question.

One-dimensional bi-stable networks were previously studied by A. Cherkaev, E. Cherkaev, Slepian, Truskinovsky and others. The two-dimensional case is more difficult than the one-dimensional, because the elongations in the two-dimensional network must satisfy certain compatibility conditions that do not arise in the one-dimensional case. For the case of small deformations, we provide a complete analysis of the compatibility conditions and show that they are analogous to the compatibility conditions in linear elasticity. Compatibility conditions for arbitrary deformations will be also presented.

This is a joint work with A. Cherkaev (University of Utah) and A. Kouznetsov (Washington State University).