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INTERACTION OF APPLIED MATHEMATICS AND MECHANICS CONFERENCE IAMMC2017

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IAMMC 2017 INTRODUCTION, PROGRAM AND ABSTRACTS

INTERACTION OF APPLIED MATHEMATICS AND MECHANICS CONFERENCE IAMMC2017

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conserved quantities of the models are systematically computed and discussed, along with other related mathematical properties. Sample numerical solutions originated from symmetry analysis are presented.

Topology Optimization in Nano-Scale – New Graphene-Like Materials

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Director and full professor of the Institute of Fundamental Technological Research of the Polish Academy of Sciences (IPPT PAN). He is corresponding member of the Polish Academy of Sciences (PAS) and President of the Committee on Mechanics of PAS.

He established a scientific school in the field of application of the boundary element method (BEM) to sensitivity analysis and optimization. He also developed original concepts of stochastic and fuzzy BEM for the analysis of systems with uncertain parameters.

He developed and applied computational intelligence systems based on biologically-inspired techniques (evolutionary algorithms, artificial immune systems, and particle swarm optimization) and fuzzy systems in optimization and identification. Recently, he elaborated a methodology for optimization in multi-scale problems, especially in nano-scale.

The paper describes an application of a hybrid algorithm to optimal searching for new, stable atomic arrangements of two-dimensional graphene-like carbon lattices. The proposed approach combines the parallel evolutionary algorithm and the conjugated-gradient optimization technique [1]. The main goal of the topology optimization is to find stable arrangements of carbon atoms under certain imposed conditions such as density, shape and size of the unit cell. The objective function is formulated as the total potential energy of an atomic carbon system. The optimized structure is considered as a discrete atomic model and interactions between atoms are modeled using the AIREBO potential [2], especially developed for carbon and hydrocarbon materials. The parallel approach used in computations allows significant reduction of computation time. Validation of the obtained results and examples of the two models of the new grapheme-like materials named X and Y are presented in Fig. 1.

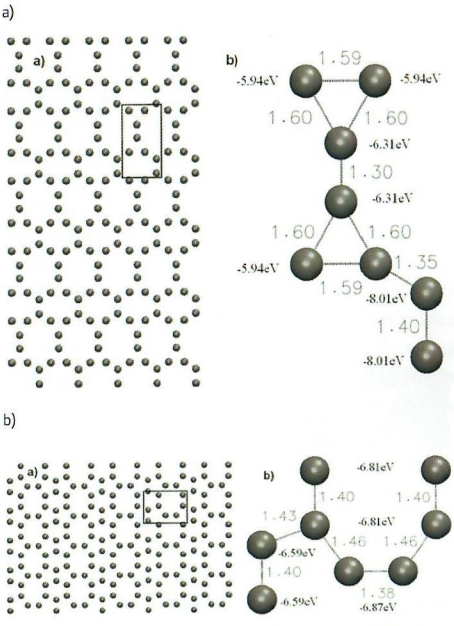

Fig. 1 Layout of new stable carbon networks X (a) and Y (b) found by the hybrid algorithm

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[1] Mrozek A., Kuś W., Burczyński T., *Nano level optimization of graphene allotropes by means of hybrid parallel evolutionary algorithm*, Computational Materials Science 106: 161-1, 2015.

[2] Stuart S.J., Tutein J.A., Harsison A., *A reactive potential for hydracarbons with intermolecular interactions*. J. Chemical Physics 112: 6472-6486, 2000.

The variational approach to fracture: formulation, general properties and examples

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The lecture is devoted to gradient damage models which allow us to describe all the process of degradation of a body including the nucleation of cracks and their propagation. The construction of such model follows the