Fourteenth International Conference on
Geometry, Integrability and Quantization
June 8–13, 2012, Varna, Bulgaria
Ivaïlo M. Mladenov, Andrei Ludu
and Akira Yoshioka, Editors
Avangard Prima, Sofia 2013, pp 244–252
doi: 10.7546/giq-14-2013-244-252

UNDULOID-LIKE EQUILIBRIUM SHAPES OF SINGLE-WALL CARBON NANOTUBES UNDER PRESSURE

VASSIL M. VASSILEV

Institute of Mechanics, Bulgarian Academy of Sciences Acad. G. Bontchev Str. Block 4, 1113 Sofia, Bulgaria

Abstract. In this work, a continuum model is used to determine in analytic form a class of unduloid-like equilibrium shapes of single-wall carbon nanotubes subjected to uniform hydrostatic pressure. The parametric equations of the profile curves of the foregoing shapes are presented in explicit form by means of elliptic functions and integrals.

1. Introduction

The study of the mechanical response of carbon nanotubes subjected to different types of loading has attracted a lot of attention in the last two decades. This interest emerged shortly after the experimental discovery of multi-wall [11] and single-wall [2,12] carbon nanotubes and the reported progress in their large-scale synthesis [6]. It is motivated to a large extend by the observed remarkable mechanical and shape-dependent thermal, optical and electrical properties of these carbon allotropes with promising applications in nano technology.

It is observed (see, e.g. [25]) that under different growth conditions, carbon nanotubes take different kinds of stable or metastable shapes (straight, curved, helical).

The aim of the present work is to give an analitic description of a class of axisymmetric equilibrium shapes of single-wall carbon nanotubes (SWCNT's) subjected to uniform hydrostatic pressure. For that purpose we use the continuum model developed by Ou-Yang *et al* [18,20,22]. This model is based on the continuum limit of the interatomic interaction potential proposed by Lenosky *et al* [14] to describe the deformation energy of a single layer of curved graphite carbon, which has been modified recently by Tu and Ou-Yang [22] to take into account that the energy