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Torusenes are defined as closed sp2-hybridized pure carbon networks of toroidal geometry. The first we call hexagonal torusenes contains purely polyhex networks and the second class which we call 5,6,7-ring torusenes comprises torusenes which besides hexagons contain also an equal number of 5- and 7-membered rings. We study here geometries of torusenes. One is interested in methods which are simple to apply but which are still able to produce plausible geometries. One of them is offered by the Adjacency Matrix Eigenvectors (AME) method. The application of the AME is based on an appropriate choice of the triplet of eigenvectors, and the choice is governed by the nodal properties of eigenvectors. No rules have been formulated up to now how to apply the AME to torusenes. In order to find such a rule a systematic study of nodal properties is crucial. Such a study is the subject of the present paper (1). In order to understand better these nodal properties, a quantum-mechanical study of free electrons on the surface of torus was also undertaken. Theoretical and computer experimental considerations suggest that the first two members of the optimal triplet of AM eigenvectors are the 2nd and 3rd eigenvector while the last one should be searched for among those eigenvectors which posses no radial plane but one axial cut. In the present paper the above findings have been elaborated for 5,6,7-membered rings torusenes with up to 270 atoms but computer experiments have shown that the similar findings hold also for purely polyhex torusenes with up to 224 carbon atoms.

Besides torusenes another objects like prisms have been studied (2) and rules found how to obtain their plausible geometry by applying the AME method. Some improvements (Ante Graovac et al., Chem. Phys. Lett., in press) of the results of Ref. 1 will be also presented.