

1113-05-284

Baogang Xu and **Xiaoya Zha*** (xzha@mtsu.edu), Department of Mathematical Sciences,
Middle Tennessee State University, Murfreesboro, TN 37132. *Thickness and outerplanar thickness
for embedded graphs.*

The *thickness* $\theta(G)$ of a graph G is the minimum number of planar subgraphs whose union is G , and the *outerplanar thickness* $\theta_o(G)$ is obtained where the planar subgraphs in the definition of thickness are replaced by outer planar graphs. Dean and Hutchinson provided upper bounds for thickness of graphs in terms of their orientable genus. Concalves proved that the outerplanar thickness of any planar graph is at most 2. We apply the method of deleting spanning disks of embeddings to approximate the thickness and outerplanar thickness of graphs. We first obtain better upper bounds for thickness. We then use a similar approach to provide upper bounds for outerplanar thickness of graphs in terms of their orientable and nonorientable genera. Finally we show that the outerplanar thickness of the torus (the maximum outerplanar thickness of all toroidal graphs) is 3. We also show that all graphs embeddable in the double torus have thickness at most 3 and outerplanar thickness at most 5. (Received August 25, 2015)