Structural properties of essentially-highly-connected polyhedral graphs

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A k-connected graph is called essentially $(k + 1)$-connected if each its vertex k-cut leaves at most one nontrivial component. We explore the local structure of essentially 4- and 5-connected plane graphs, focusing on existence of small clusters of faces of small sizes as well as the small subgraphs (or sets of subgraphs) having vertices of degrees upper bounded by small constants; as an application, we show that the cyclic edge connectivity of essentially 5-connected plane graphs is finite.