On the Sphericity of 3-Connected Digraphs

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An upward embedding of a digraph D on an embedded surface S is an embedding of its underlying graph on the surface such that all arcs are represented by monotonic curves that point to a fixed direction. A digraph is called *spherical* if it has an upward embedding on sphere. It has been proved that for upward embedding, plane and sphere are not equivalent which is in contrast with the fact that they are equivalent for undirected graphs. The decision problem whether a digraph is spherical is an NP-Complete problem. There is a combinatorial necessary and sufficient condition for the sphericity of 3-connected single source digraphs by which an efficient algorithm to test whether a 3-connected single source digraph is spherical has been developed. In this paper we present a combinatorial sufficient and also a combinatorial necessary condition for the sphericity of 3-connected digraphs.

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