Given a finite simplicial 2-complex $K$ embedded in an oriented 3-manifold, a right-hand rule assigns to each directed edge $e$ of $K$ a cyclic order $\rho(e)$ of the incident 2-simplices, such that $\rho(e^-) = \rho(e)^{-1}$. This 3D-rotation system induces a planar (usual) 2D-rotation system for the link $L(v)$ of each vertex $v$. Conversely, an assignment of a cyclic order $\rho(e)$ to each directed edge which induces a planar embedding of $L(v)$ for each $v$, defines a thickening $T_\rho$ of $K$, that is, a regular neighborhood of $K$ in an oriented 3-manifold. Unlike the case for graphs, $T_\rho$ may have non-sphere boundary components, so there is no canonical closed 3-manifold associated with $\rho$. Nevertheless, the boundary components of $T_\rho$ can be constructed, similar to face-tracing for a 2D-rotation, so it can be decided whether a given 2-complex has a thickening where all boundary components are spheres. Combining this with the Rubinstein-Thompson sphere recognition algorithm, we can decide whether a given 2-complex has a cellular embedding in the 3-sphere. This approach relates to work of Neuwirth (1968); Archdeacon, Bonnington, Richter, Širáň, (2002); Repovš, Brodskij, Skopenkov (1999); and Lasheras (1999). (Received September 15, 2011)