Using analysis and topology to count nonbacktracking walks in biregular graphs

Elementary graph theory uses the adjacency matrix to calculate the number of closed walks in a graph. Getting detailed information for closed walks without backtracking is less elementary.

This work treats biregular graphs, which have two classes of vertices, edges between classes, and degrees depending on class. Solution operators for differential equations 'replace' the adjacency matrix. Trees are analyzed first. Basic covering space ideas link the tree calculations to generating functions for closed nonbacktracking walk counts for finite biregular graphs. Various explicit formulas result.