1086-57-1949 **Jeff Erickson*** (jeffe@cs.uiuc.edu). *Transforming Curves on Surfaces Redux.*

Just over 100 years ago, Max Dehn described the first combinatorial algorithm to determine whether two given cycles on a compact surface are freely homotopic, meaning one cycle can be continuously deformed into the other without leaving the surface. We describe a simple variant of Dehn's algorithm that runs in linear time, with no hidden dependence on the genus of the surface. Specifically, given a combinatorial surface of complexity $n$ and two closed vertex-edge walks of length at most $\ell$ in that surface, our algorithm determines whether the two walks are freely homotopic in $O(n + \ell)$ time. Our algorithm simplifies and corrects a similar algorithm of Dey and Guha and simplifies the more recent algorithm of Lazarus and Rivaud, who identified a subtle flaw in Dey and Guha's techniques. Our algorithm combines components of these earlier algorithms, classical results in small cancellation theory by Gersten and Short, and simple run-length encoding.

This is joint work with Kim Whittlesey. (Received September 24, 2012)