Phillip R. Dukes* (phillip.dukes@utrgv.edu), Phillip R. Dukes, University of Texas Rio Grande Valley, Brownsville, TX 78520. Continuous-time quantum walks over simply connected graphs, amplitudes and invariants.

We examine the time dependent amplitude \( \phi_i(t) \) at each vertex \( i \) of a CTQW on a variety of simply connected graphs. The Lissajous curve of the real vs. imaginary parts of each \( \phi_i(t) \) reveals interesting shapes of the space of time-accessible amplitudes. We find two invariants of CTQW’s. First, considering the rate at which each amplitude evolves in time the quantity \( T = \sum_{i=0}^{n-1} \left| \frac{d\phi_i(t)}{dt} \right|^2 \) is time invariant. The value of \( T \) for any initial state can be minimized with respect to a global phase factor \( e^{i\theta t} \) to some value \( T_{min} \). An operator for \( T_{min} \) is defined. For any simply connected graph \( g \) the highest possible value of \( T_{min} \) with respect to the initial state is found to be \( T_{min}^{max} = \left( \frac{\lambda_{max}}{2} \right)^2 \) where \( \lambda_{max} \) is the maximum eigenvalue in the spectrum of \( g \). A second invariant is found in the time-dependent probability distribution \( P_i(t) = |\phi_i(t)|^2 \) of any initial state satisfying \( T_{min}^{max} \), with these conditions \( \sum_{i=0}^{n-1} \left( P_{i}^{max} - P_{i}^{min} \right)^2 = \frac{4}{n} \) for all simply connected graphs of \( n \) vertices. (Received September 16, 2015)