Locating Periodic Orbits by
Topological Degree Theory

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We consider methods based on the topological degree theory to compute periodic orbits of area preserving maps. Numerical approximations to the Kronecker integral give the number of fixed points of the map provided that the integration step is small "enough". Since in any neighborhood of a fixed point the map gets four different combination of its algebraic signs we use points on a lattice to detect the candidate fixed points by selecting boxes whose corners show all combinations of sign. This method and the Kronecker integral can be applied to bounded continuous maps such as the beam-beam map. On the other hand they cannot be applied to maps defined on the torus, such as the standard map which has discontinuity lines propagating by iteration, or unbounded maps such as the Henon map. However, the systematic use of the bisection method initialized on the lattice, even though unable to detect all fixed points of a given order, allows us to find a sufficient number of them to provide a clear picture of the dynamics, even for maps of the torus because the discontinuity lines have measure zero.