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Stability of periodic orbits by index methods

Roughly speaking, the Conley-Zehnder index measures the number of half windings of a fundamental solution for a periodic linear Hamiltonian system. This index, and its closely related cousin the Morse index for the equivariant action functional, can be used to give non perturbative arguments for linearized stability and instability for families of periodic orbits in Hamiltonian systems. We will give several examples of this from the setting of parametric resonance in parameterized families, to minimum distance lines in kinetic plus potential systems. Using a necessary and sufficient condition for elliptic stability of periodic orbits in two degree of freedom systems, we ouline the global argument for families of hyperbolic orbits in the Henon-Heiles system.