Periodic orbits near a bifurcating slow manifold

This paper studies a class of $1\frac{1}{2}$-degree-of-freedom Hamiltonian systems with a slowly varying phase that unfolds a Hamiltonian pitchfork bifurcation. The main result of the paper is that there exists an order of $\ln^2\epsilon^{-1}$-many periodic orbits that all stay within an $O(\epsilon^{1/3})$-distance from the union of the normally elliptic slow manifolds that occur as a result of the bifurcation. Here $\epsilon$ measures the time scale separation. These periodic orbits are predominantly unstable. The proof is based on averaging of two blowup systems, allowing one to estimate the effect of the singularity, combined with results on asymptotics of the second Painleve equation. The stable orbits of smallest amplitude that are obtained by these methods remain slightly further away from the slow manifold being distant by an order $\mathcal{O}(\epsilon^{1/3}\ln^{1/2}\ln \epsilon^{-1})$.

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