

Not clear?

As there is no damping, $M(t_0) \propto \cos \Omega t_0$ so always has a simple zero. Therefore there is always chaotic motion near the separatrix if $\epsilon \neq 0$. If $|\epsilon|$ is too large, the motion on the separatrix will be disturbed so $q_s(t)$ and $p_s(t)$ will not describe the motion accurately, and the Melnikov function will be invalid $\therefore |\epsilon|$ must be small.

$$M(t_0) = 0 \quad \text{when} \\ \cos \Omega t_0 = 0.$$

$$\Omega t_0 = (2n+1) \frac{\pi}{2}$$

Simple zeros at these values. So

See again the problem on page 112. ~~Ex~~
and the example I sent you, following the tutorial

Total 17/25