Examples of Perturbation Hamiltonians

$\hat{H}$ is the total Hamiltonian of the system where $\hat{H}_0$ is the unperturbed, and $\hat{H}'$ is the perturbed Hamiltonians.

Name	***Description***	***Hamiltonian***
Stark effect	One-electron atom in a constant, uniform electric field $\vec{E} = q_z E_0$.	$\hat{H} = \hat{H}_0 + \hat{H}'$ $\hat{H}_0 = \hat{p}^2/2m - q^2 Z/r$ $\hat{H}' = qE_0 z$
Anharmonic oscillator	Spring with nonlinear restoring force	$\hat{H} = \hat{H}_0 + \hat{H}'$ $\hat{H}_0 = \hat{p}_x^2/2m + \frac{1}{2}Kx^2$ $\hat{H}' = K'x^4$
Nearly free electron model	Electron in a periodic lattice	$\hat{H} = \hat{H}_0 + \hat{H}'$ $\hat{H}_0 = \hat{p}_x^2/2m$ $\hat{H}' = V(x) = \sum_n V_n \exp[i(2\pi nx/a)]$
Zeeman effect	One electron atom in a constant, uniform magnetic field, $\vec{B}$.	$\hat{H} = \hat{H}_0 + \hat{H}'$ $\hat{H}_0 = \hat{p}^2/2m - q^2 Z/r$ $\hat{H}' = (q/2mc)\hat{J}\cdot\hat{B}$
L-S coupling	Coupling between orbital and spin angular momentum in a one-electron atom	$\hat{H} = \hat{H}_0 + \hat{H}'$ $\hat{H}_0 = \hat{p}^2/2m - q^2 Z/r$ $\hat{H}' = f(r)\hat{L}\cdot\hat{S}$

Reference: Introductory Quantum Mechanics by Richard L. Liboff