New approach [1] to study the spontaneous emission of the atomic system in the presence of the high-intensity laser field is used to study the process of harmonic generation. The analysis is based on the consideration of quantum system interaction with quantized field modes being in vacuum state, while the intense laser field is considered classically beyond the perturbation theory. The numerical analysis of the emission from the single one-electron one dimensional atom irradiated by the femtosecond laser pulse of Ti-Sa laser is discussed. It is demonstrated that not only odd but also even harmonics as well as lines associated with transitions between different discrete levels can be emitted if the laser field is strong enough. The origin of appearance of even harmonics is studied. It is explored that they result from the bremsstrahlung which becomes efficient in the regime of strong ionization. The obtained results are compared with that found in the frames of semiclassical approach widely used to study the harmonic generation. It is found that semiclassical approach is inapplicable in the strong-field limit.

References