Nonlinear Bunch Motion in an Accelerator with Reactive Impedance, E. SHAPOSHNIKOVA, CERN - Closed form solutions have been found for single particle and bunch motion in an accelerator with reactive (space charge or inductive wall) impedance. The problem is solved for the particular initial longitudinal distribution corresponding to a parabolic line density. In the case with RF off the system of equations in phase space is the same as that describing motion of a body under a gravitational force with integrals of motion similar to Kepler's laws. With RF on this model allows the amplitude and frequency of coherent bunch shape oscillations to be calculated for a bunch of any intensity far away from equilibrium. The results have been used to estimate the low-frequency impedance of the CERN SPS.