This paper is a study on dynamic behavior of a snake robot, called Serpentine robot, 2nd version (SR#2). The SR#2 is the latest version of snake robots developed at FIBO as a research platform for studying serpentine gaits. The gait is in form of sinusoidal curve, considered one of the most effectiveness crawling pattern in the natural world. The Active Cord Mechanism (ACM) assumption, initiated by Hirose, is implemented. The robot motion results from different joint torques and frictional reacting forces in each wheel. In this study, we proposed a modified serpeniod function with steering command to control the robot's direction. We also performed dynamic analysis using Kane's method. Holonomic constraints under frictional forces and nonholonomic constraints unders velocities were considered. We verified our algorithm for directional control on this Serpentine robot both simulation and experiment.