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PHASED COMPLIANCE CONTROL WITH VIRTUAL FORCE FOR SIX-LEGGED WALKING ROBOT

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Abstract. *Decreasing impact force between the foot and the terrain when the foot lifting and landing, which is one of the most important problems for the multi-legged walking robot on the irregular terrain, because it negatively affects the body stability and sometimes destroys robot mechanical parts. Therefore this paper proposed a phased compliance control using virtual force for multi-legged walking robot, which can effectively reduce the impact force when the robot walks. Moreover, we designed a hierarchical control system for multi-legged walking robot, which is combined the proposed phased compliance control with a posture and vibration control based on virtual suspension model, to realize the stable walking on unknown rough terrain. The effectiveness of the proposed method is verified by the walking experimental results of the developed six-legged walking robot.*

Keywords: Six-legged walking robot, Phased compliance control, Virtual force, Posture and vibration control, Softly walking

1. **Introduction.** Recently, although the researches on the terrain adaptability of multi-legged walking robot have been widely performed [1-6], it has not been put to more widely practical use. This is because there are still some problems in the stable walking of multi-legged robot that need to be solved. For example, shown as in Figure 1(a) (b) and Figure 2(a) (b), when the swing legs of robot moves, because the COG, supported weight, and moment of inertia of body change dynamically, the posture of robot body become unstable; And with the switch between the swing leg and the support leg shown as in Figure 1(c) and Figure 2(c), there occur the collisions and slippage between the foot and the ground. Because of the above uncertain disturbances, the tiny vibrations occur when the robot is walking. Until now, we proposed a robust control of posture and vibration based on virtual suspension model for multi-legged walking robot to decrease the tiny vibrations when the robot walks [7][8]. However, how to decrease the impact force between the foot and the terrain has not been solved yet. As shown as in Figure 1(c) and Figure 2(c), when the robot walks on irregular terrain or it bumps against the obstacle, due to the influence from the impact force between the foot and the ground, it is a possibility that the mechanical parts of robot are destroyed; moreover, the vibration