

Due to upload size limitations, we provide additional demos on a website:

[https://anonymous.4open.science/w/HWC\\_Loco\\_demo/](https://anonymous.4open.science/w/HWC_Loco_demo/)

## Real-World Experiments:

1. **Hard Kick Test:** The robot experiences a strong kick, causing a brief slip, but quickly recovers from the extreme state. (Video: “Hard Kick”)
2. **Challenging Terrain Locomotion:** Tests on stairs, slopes, discrete, soft, and slippery terrains. (Videos: “Hard Slope” “Discrete Terrain” “Soft and Slippy Terrain”)
3. **Omni-Directional Control:** The robot continues to maintain balance despite disturbances during locomotion. (Video: “Omni Control”)
4. **Random User Command:** The robot handles malicious commands while maintaining stability. (Video: “Malicious Commands”)
5. **Outdoor Tests:** Including normal walking with multiple disturbances, navigating slopes up to 30°, uneven terrains with grass bales, and smooth surfaces. (Videos: “Forward Walking” “Slope Up” “Slope Down” “Uneven Slope1” “Uneven Slope2”)

## Simulation Experiments:

1. **Impulse Impact:** The robot demonstrates arm-waving to maintain balance when subjected to a strong push. (Videos: “Recovery in High-speed” “Recovery in Low-speed”)
2. **Motion-Tracking Tasks under Disturbances:** Experiments include boxing, dancing, and expressive walking, where the robot maintains balance under external interference. (Videos: “Punching” “Dancing” “Expressive Walking”)
3. **G1 Straight Knee Walking:** G1 demonstrates straight knee walking, exhibiting human-like gait behavior. (Video: “G1 Walking”)