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ABSTRACT

Traditional legged robots are capable of traversing challenging terrain, but lack of energy efficiency and speed when compared to wheeled systems. We propose a novel motion planner and controller framework which enables a legged robot equipped with passive or powered wheels to perform hybrid locomotion, represented by an appropriate combination of driving and stepping maneuvers. Our approach relies on an online motion planner which continuously updates the gait-sequence, step-timings, moving footholds, swing-leg motions and 6D body motion over non-flat terrain as a function of the state of the robot. We propose a novel motion controller which reformulates a hierarchical whole-body controller which takes into account the nonholonomic constraints introduced by the wheels. Our approach is planned to be tested on the torque-controllable robot ANYmal equipped with wheels as end effectors. We already conducted first experiments with passive wheels on flat and inclined terrain, whereby we show that skating motions reduce the cost of transport by up to 80\,\% with respect to traditional walking gaits.