

Omnidirectional Walking

The gait of most bipedal robots is controlled by precomputed trajectories, however, in robot soccer, a dynamic environment forces the robot to adapt their walking direction, speed and rotation to the changes [1]. A robot should be able to arrive at any point in the field and in its sight. And it should rotate itself towards the aim. Based on predefined walking styles, complex path planning algorithm is needed. The generated series of gait can be eliminated when surrounding varies to some extent.

Our goal is capsule the biped robot into an omnidirectional moving platform in the view of the mounted camera on head, and making gait parameterized with 3 pa-rameters: offset in forward and sidle direction and another rotation direction around Z axis.

Several walking strategies have been developed, most of which are based on the Three-Dimensional Linear Inverted Pendulum [2]. Firstly, foot trajectory is directly deduced from the foot planner from the gait command. Second, the center of pressure trajectory is defined based on ZMP discipline. COM trajectory is simply related to that of COP assuming the robot as a three-dimensional linear inverted pendulum [3][4][5]. Third, inverse kinematics generates joint trajectories based on the former foot and COM trajectories. An analysis resolution of inverse kinematics can be derived from the specific hip configuration of MOS 2013, which ensured the 3 joints intersected on a single point. [6] had issued the details of this method.

In our research, multiple formulas describing the trajectories are sampled, normalized, and saved in motion control board, and thus both of trajectory type and gain can be adjusted offline, and leaves joint trajectories generated online. An accelerating and decelerating algorithm is also developed to cope with a sudden change of walking speed command from behavior.

References

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