

Summary: The RoboCup community has one definite goal [H. Kitano, M. Asada, RoboCup humanoid challenge: That’s one small step for a robot, one giant leap for mankind, in: IEEE/RSJ Int. Conf. on Intelligent Robots and Systems, IROS1998, Victoria, pp. 419-424, 1998]: winning against the human world soccer champion team by the year 2050. This implies real tackles and fouls between humans and robots, rising safety concerns for the robots and even more important for the human players. Nowadays, similar questions are discussed in the field of physical human-robot interaction (pHRI), but mainly in the context of industrial and service robotics applications. The first part of our paper is an attempt for a pHRI view on human-robot soccer. We take scenes from real soccer matches and discuss what could have happened if one of the teams consisted of robots instead of humans. The most important result is that elastic joints are needed to reduce the impact during collisions. The second and third part consider conversely, how the robot can handle the impact of kicking the ball and how it can reach the velocity of human-level soccer. Again joint elasticity is the key point. Overall, the paper analyzes a vision far ahead. However, all our conclusions are based on concrete simulations, experiments, derivations, or findings from sports science, forensics, and pHRI.

Keywords: RoboCup; human-robot soccer; safe robot; kicking; elastic joints; variable stiffness actuation
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