Humanoid Robot ‘HanSaRam’: Recent Progress and Development

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Abstract:

Humanoid robot HanSaRam has been developed in the RIT Lab, KAIST since 2000. Since then, each year a new version has been developed such that the latest one is HanSaRam-VIII. This talk deals with two issues for humanoid robot. One is the navigation within complex environments. For this purpose, a novel algorithm, which can modify a walking period and a step length in both sagittal and lateral planes, is presented. By allowing a variation of ZMP over the convex hull of foot polygon, it is possible to change the CM position and velocity independently throughout the single support phase. This permits a range of dynamic walking motion, which is not achievable using the 3D Linear Inverted Pendulum Mode (3D-LIPM). Moreover, adopting the closed form of ZMP functions makes it possible to calculate the algorithm in real-time. The other issue is dynamic walking on inclined plane. For this walking, a novel stabilization controller is presented, which consists of landing force control, posture control and walking pattern generation. The proposed stabilization controller does not require complex dynamic equation of robot and adjustment of control parameters because the controller is based on time-domain passivity approach. Moreover, it can guarantee the stability of the controller without needing any dynamic model information. The effectiveness of the two schemes above is demonstrated through both computer simulations and experiments on HanSaRam-VII and -VIII, respectively. HanSaRam-VII was the champion in the RoboMarathon under HuroCup at 2007 FIRA RoboWorld Cup USA.
Jong-Hwan Kim joined the Department of Electrical Engineering and Computer Science, KAIST, Korea in February 1988 and is currently a full professor. Dr. Kim established two national robotics research centers in 2000 and 2003, respectively, as Director and has been serving as Director for KT RoboLab@KAIST since 2007. His research interests include evolutionary algorithm, computational intelligence, evolvable artificial creature, soccer robotics, ubiquitous and genetic robotics and cyber-physical robotic system. Dr. Kim has authored 5 books and 2 edited books, 2 journal special issues and around 300 book chapters and refereed papers in technical journals and conference proceedings and his current h-index is 25 along with over 2,000 number of citations. He has delivered over 130 invited talks including 32 keynote speeches at the international conferences in 21 countries. Dr. Kim was an advisory professor for the weekly television drama, ‘KAIST’ of SBS, which was aired over one year starting in Jan. 1999. His activities have been introduced as news items and articles in world media such as CNN, BBC, The Times, etc. and as documentaries four times in Korea television broadcasting.
companies including KBS, MBC, etc. (http://rit.kaist.ac.kr/home/jhkim/Media). Dr. Kim currently serves as an Associate Editor of the IEEE Transactions on Evolutionary Computation, the IEEE Computational Intelligence Magazine and the International Journal of Social Robotics. He was one of the co-founders of the International Conference on Simulated Evolution and Learning (SEAL) in 1996. He was General Chair for the IEEE Congress on Evolutionary Computation, Seoul, Korea, 2001 and is General Chair for the IEEE International Symposium on Computational Intelligence in Robotics and Automation, Jeju Island, Korea, 2009 and Honorary Chair for FIRA RoboWorld Congress, Incheon, Korea, 2009. He has been on the program committees and advisory boards of more than 100 international conferences and co-chaired several international conferences. His name was included in the Barons 500 Leaders for the New Century in 2000 as the Father of Robot Football. Dr. Kim is the Founder of FIRA (The Federation of International Robosoccer Association) and IROC (The International Robot Olympiad Committee). He is currently serving FIRA and IROC as President. Dr. Kim was the recipient of the science and technology award from the President of Republic of Korea in 1997 and has been elevated to 2009 IEEE Fellow.