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Abstract
This thesis presents the design of a small-size humanoid robot and its application to robot soccer games. In which, there are three sub-systems discussed mainly, that is the visual perception, the locomotion control and the decision-making sub-systems. In the visual perception sub-system, color image processing procedures, which include color and geometry segmentations and the multi-condition color mask model, provide the robot the ability to distinguish those different objects with the same color under varied brightness. Besides, since a high performance DSP is adopted as the visual processor, a real-time robotic vision can be achieved. Moreover, this thesis proposes a design method of biped robot locomotion controllers based on the inverse learning model of ANFIS (Adaptive Neuro-Fuzzy Inference Systems). In which, an integrated ANFIS structure were training to be the system identifier for modeling the inverse dynamics of the biped robot. After the modeling, the resultant parameters can be duplicated as those of the biped locomotion controller to provide favorable control actions. For robot soccer games, the decision-making sub-system based on the finite state machine was proposed to switch behavior modes of the robot according to the visual feedback signals. As the experimental results show, this small-size humanoid robot is capable to play robot soccer games with satisfactory performance.
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