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## II. Humanoids

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Since the recent inception of humanoid robots in Japan, this fascinating field of research has been receiving a great deal of interest world-wide. The papers in this chapter address some of the important issues in design and control of humanoids.

Bischoff and Graefe focus on dependability as a necessary requirement in the design of intelligent service robots. The basic design strategies at the basis of the concept are: learning from nature, providing natural and intuitive communication and interaction, designing for ease of maintenance, striving for a tidy appearance. The principle is applied in the construction of a humanoid robot and extensively tested in an office environment.

Yokoi *et al.* present an effective way to replace the existing controller of a humanoid robot with a new hardware unit ensuring enhanced biped locomotion. Several experimental results demonstrate the capability of the system to perform whole body motions and walk on unknown and uneven terrains stably.

Nishiwaki *et al.* achieve autonomous walking capabilities by resorting to a 3D vision system which is implemented as a layered control architecture. A moving goal tracking function and reactive obstacle avoidance are implemented together with a stereo vision system, forming higher layer components of an autonomous locomotion system.

Gienger, Löffler, and Pfeiffer concentrate on the practical aspects of biped locomotion such as the sensor system, the control scheme with trajectory generation, and the foot dynamics. Performance for dynamically stable walking is tested, where the ground reaction forces and torques at the robot's feet have to be confined to avoid slippage and tilting of the foot.