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Human-like compliant locomotion: State of the art of robotic implementations (Review) (Open Access)

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Abstract

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This review paper provides a synthetic yet critical overview of the key biomechanical principles of human bipedal walking and their current implementation in robotic platforms. We describe the functional role of human joints, addressing in particular the relevance of the compliant properties of the different degrees of freedom throughout the gait cycle. We focused on three basic functional units involved in locomotion, i.e. the ankle-foot complex, the knee, and the hip-pelvis complex, and their relevance to whole-body performance. We present an extensive review of the current implementations of these mechanisms into robotic platforms, discussing their potentialities and limitations from the functional and energetic perspectives. We specifically targeted humanoid robots, but also revised evidence from the field of lower-limb prosthetics, which presents innovative solutions still unexploited in the current humanoids. Finally, we identified the main critical aspects of the process of translating human principles into actual machines, providing a number of relevant challenges that should be addressed in future research. © 2016 IOP Publishing Ltd.

SciVal Topic Prominence

Topic: Robots | Anthropomorphic robots | stable walking

Prominence percentile: 97.985

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biomechanics | compliance | human likeness | humanoids | robotics | walking

Indexed keywords

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Engineering uncontrolled terms	compliance, Human bipedal walkings, Human likeness, humanoids, Innovative solutions, Robotic implementation, Robotic platforms, walking
Engineering main heading:	Robotics
EMTREE medical terms:	ankle, biomechanics, biomimetics, foot joint, gait, hip, human, knee, leg, limb prosthesis, locomotion, pelvic girdle, physiology, robotics, walking
MeSH:	Ankle Joint, Artificial Limbs, Biomechanical Phenomena, Biomimetics, Foot Joints, Gait, Hip Joint, Humans, Knee Joint, Leg, Locomotion, Pelvic Bones, Robotics, Walking

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