Bionic Robotics

Position Paper

Bionics deals with studying and technical harnessing of inventions made by the animated nature in course of the evolution process. For robotics and automation a wide range of new approaches emerge by that, in the design sector and in the control sector as well. By use of latest manufacturing technologies innovative prospects for education and applications in industry, rehabilitation and elder care arise.

In recent years Bionics was successively established as own interdisciplinary field of Science. Transparence increased and a global innovative reseach field emerged in academic and industrial sectors. [Gruber and Blust, 2010]

In Engineering important factors for sustainable system solutions are energy consumption, environmental impact of materials and energy sources used and mechanical properties of components, among others. An optimal component configuration with the best trade-off between mass and flexural strength is essential in the mechanical point of view. An insight into the realm of nature reveals several promosing approaches at the small as well as at the biggest life forms: Insects are of interest for modeling multi-chain extremities on the one side. On the other side the structure of bones, e.g. of dinosaurs, shows a design which enables to shore up large masses at low Eigen-mass.

Originally Robotics was defined as the science which studies the intelligent connection between perception and action. Therefore, the action of a robotic system is entrusted to a locomotion apparatus to move in the environment and/or to a manipulation apparatus to operate on objects present in the environment, where suitable actuators animate the mechanical components of the robot. The perception is extracted form sensors providing information on the robot and its surrounding environment. The intelligent connection is entrusted to a programming, planning and control architecture which relies on the perception and available models of the robot and environment and exploits learning and skill acquisition. [Siciliano and Kathib, 2008]

There are several professional CAD (Computer Aided Design) products, which are used in engineering. Depending on the field of application – architecture, mechanical design, electronics – products are more or less specialized, additional calculation modules and interfaces to computer aided manufacturing (CAM) are available. Generally investment costs are high, interoperability between products of different providers is seldom, with restrictions, possible in the 3D sector.

The use and further development of the open source program Blender™ [www.blender.org] for 3D design represents a cost-effective alternative and offers advantages to classic 3D-design products in some areas. Additvie manufacturing technologies (3D-printing) enable to produce complex system components which cannot be made by classical production methods. Different materials can be used, depending on the

technology. A further clear advantage opposite to mass production, which needs cost-intensive tools and devices, is the absolute economic producibility of batch size 1. This means, that a bionic prototype can be adapted to varying constraints without further investment into production machines and gadgets. This is essential at varying, biometric main and mounting dimensions, for instance.

Consequently researching bionic robotics generates new impacts on CAD and Open Source through the connection of engineering and animation, rendering, virtual production, 3D-printing and game development. The findings obtained can directly be used for knowledge transfer and for the development of robots, exo-skeletons, artificial limbs and handling devices.

References

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Further information

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