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Biomimetics - Terminology, concepts and methodology

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foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part 1.Structure and Drafting Rules for Standardization Documents"

drafting.

This document is equivalent to ISO 18458.2015 "Terms, Concepts and Methodologies of Bionics".

This document adds a chapter "Normative References".

Please note that some contents of this document may refer to patents. The issuing agency of this document assumes no responsibility for identifying patents.

Introduction

Biomimicry is considered to be a research and development method oriented to practical application benefits, through the analysis of knowledge acquired from biological systems, to find

solutions to problems, create new inventions and innovations, and translate this knowledge into technological systems. This transfer of biological principles to the technical

The idea of domain is the core content of bionics (see the connotation of bionics in Chapter 4).

The fundamental motivation behind the translation of biological solutions into technological applications stems from the fact that biological structures can be modified according to their needs.

optimization and thus serve as a source of inspiration for important and convincing applications. So far, more than 2.5 million species and their

Specific features were identified and described to some extent. Therefore, for bionics, there are a lot of references for solving practical problems.

Throughout history, the development of bionics can be divided into the following stages [1]. around the 1950s, model-based bionics was

Introduced for the first time, it is mainly used in the design and construction of aircraft, vehicles, and ships. Through the modeling rules derived based on similarity theory, biological systems

The principle is transformed into technical design. Around the 1960s, due to the influence of cybernetics, the two pillars of bionics (biology

and technology) combined in linguistics for the first time, and established a common linguistic and methodological basis. This foundation is at the heart of the field of bionics

Elements - the transformation of knowledge has laid an important foundation. Since 1980, biomimicry has been extended to the micro- and nanoscale (e.g. lotus leaf effect

corresponding content)[2]. The emergence of new methods of measurement and manufacturing technology is key to enabling these expansions. Especially since the.1990s, the

Bionics has been further promoted by the rapid development of related fields such as computer science, nanotechnology, mechatronics and biotechnology.

In many cases, it is new developments in these fields that enable the transformation of complex biological systems [3].

Today, biomimicry is increasingly recognized as a scientific discipline that has produced numerous innovations in products and technologies. This highly interdisciplinary

Due to the cooperative nature of science and technology, it brings together experts from biology, engineering science and many other disciplines, and has great potential for innovation [4]. Depend on

Therefore, bionics has become the object of research and teaching in many universities and research institutions outside the school. At the same time, manufacturing companies are increasingly turning to

Use biomimicry to develop new products or optimize existing ones. Although more and more researchers and users are active in the field of biomimicry,

The transformation of knowledge from the field of physics to the field of technology is still a complex process, which puts forward high requirements for relevant personnel.

There are many "ingenious solutions" in nature, which can often be understood intuitively; however, it is important to explain their underlying mechanisms, especially

How they apply to technology is less straightforward. This difference is one of the reasons for their continued relevance to the current and future field of biomimicry, and

will persist for decades to come [5].

Bionics Terminology, Concepts and Methodology

1 Scope

This document classifies and defines the field of biomimicry, describes many biomimicry terms, and serves as a guide for science, industry, and education.

The term biomimicry provides the framework. At the same time, a description is given of the process from the development of new ideas to the application of bionics methods to bionic products. Book

The document also addresses the potential and limitations of biomimicry as an innovative approach or sustainable development strategy. Additionally, this document outlines the bionic

The application of bionics in different fields is described, and the differences between bionics research and development methods and classical research and development forms are described. If a technical system is in accordance with this

file for development, then it can be called a "bionic" system.

This document provides a rational framework for biomimicry applications and is intended to provide scientists and engineers working in the field of biomimicry with a general

language to provide guidance for developers, designers and users who want to understand the biomimicry development process and apply biomimicry methods to their work

guidance and support. Any targeted technological system that is sufficiently similar to a biological system created by nature to allow for the development of its technological equivalent is

apply to this document.

2 Normative references

This document has no normative references.

3 Terms and Definitions

The following terms and definitions apply to this document.

3.1

abstraction

The inductive process of drawing general conclusions from observations of a particular object.

NOTE. In biomimicry, this conclusion is an ideal physical environment for describing the underlying functions and operating principles of biological systems.

3.2

analogy

Used to describe the similarity of the relationship between two different system-related parameters.

Note 1 to entry. The specification of relevant parameters is the object of abstraction (3.1). From its definition in the field of biomimicry (3.9), one of two systems is a biological system

(3.6), another system is the technical target system.

Note 2 to entry. In biology, the term "analog" refers to the similarity of functional characteristics between different organisms, which is due to the need for adaptation, not due to

Organisms are somehow connected. In contrast, similarity based on dependencies, and thus similarity based on genetic information, is called homology. in biology

In modern science, the term "analog" has been understood dynamically, with particular emphasis on the difference between the two starting points of evolutionary development.

3.3

analysis analysis

A system in which a biological or technical system is decomposed into its component parts using appropriate methods and then combined and evaluated

examine.

Note. In terms of "decomposition into parts", the concept opposite to analysis is called synthesis (recombination).

3.4

bioengineering bioengineering

The application of engineering knowledge to the fields of medicine or biology.