

COMPARISON OF THE LAWS OF ROBOTICS BY ISAAC ASIMOV AND BEAM ROBOTICS

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Abstract: This paper conducts a comparative analysis between the ethical principles of Isaac Asimov's laws of robotics and BEAM robotics in regulating robot behavior. Asimov's laws, focused on human safety and well-being, are compared with BEAM robotics principles based on biological behavior models. It analyzes the relevance of these principles to Industry 5.0 concepts and their possible impact on the development of modern technologies are analyzed.

Key words: Industry 5.0, robotics, laws, Isaac Asimov, BEAM Robotics

ПОРІВНЯННЯ ЗАКОНІВ РОБОТОТЕХНІКИ АЙЗЕК АЗІМОВ ТА BEAM-РОБОТОТЕХНІКИ

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Анотація: У даній роботі проводиться порівняльний аналіз етичних принципів законів робототехніки Айзека Азімова і BEAM-робототехніки до регулювання поведінки роботів. Закони Азімова, орієнтовані на безпеку і благополуччя людини, порівнюються з принципами BEAM-робототехніки, заснованими на біологічних моделях поведінки. Аналізується відповідність цих принципів концепціям Industry 5.0 та їхній можливий вплив на розвиток сучасних технологій.

Ключові слова: Industry 5.0, робототехніка, закони, Айзека Азімова, BEAM-робототехніки.

With the development of robotics and the widespread introduction of robots into various spheres of human activity, there arises a pressing need to establish ethical principles that should govern the actions and decision-making of robots. Among the first attempts to formalize such principles were Isaac Asimov's "Three Laws of Robotics" in his science fiction works. However, the today's world presents an alternative approach to robot creation - the principles of BEAM Robotics, which are based on a biological model of behavior. Industry 5.0 represents a concept of the industrial revolution that focuses on the human being and his interaction with technology. In this context, a comparison of Isaac Asimov's laws of robotics and the principles of BEAM Robotics becomes even more relevant. The implementation of these principles into manufacturing processes and everyday life entails new challenges and risks that require analysis and ethical evaluation.

On the one hand, Asimov's laws, focused on human safety and well-being, can be the key ones in the context of Industry 5.0, where it is important to ensure the safety and comfort of humans working alongside robots. On the other hand, the principles of BEAM Robotics, which strive for more natural efficiency and use of biological principles, can offer new approaches to human-robot interaction in industry.

A comparative analysis of these two approaches will reveal their advantages and disadvantages in terms of ensuring safety, efficiency, and ethics in the context of Industry 5.0. This will help to develop recommendations for the effective implementation of robotics in manufacturing processes, paying attention to the human factors and ethical norms. Such an approach will be an important step towards creating a sustainable and human-centric industrial environment that complies with the principles of Industry 5.0.

Isaac Asimov's Three Laws of Robotics are a set of ethical principles governing the behavior of robots and their interactions with humans. Asimov's approach is relevant in the context of the Industry 5.0 concept, which emphasizes the importance of the harmonious coexistence of humans and technologies:

- zero's law, a robot may not injure a human being, through inaction, allow a human being to come to harm. This law corresponds to the principle of safety and risk prevention for humans in the Industry 5.0 production environment;

- unity of action law, a robot must obey the human instructions except where such orders would conflict with the first law. This principle emphasizes the importance of cooperation and coordination of actions between robots and humans within Industry 5.0;

- self-preservation law, a robot must protect its own existence as long as such protection does not conflict with the first or second law. In the context of Industry 5.0, this means that robots must be capable of protecting themselves so as not to become a source of danger to people and themselves.

Isaac Asimov's Three Laws of Robotics highlight the importance of safety, collaboration and self-regulation in the application of technology within Industry 5.0. They help to create a common platform for interaction between humans and robots, ensuring a balance between innovation and safety in manufacturing processes.

Unlike Isaac Asimov's Laws of Robotics, BEAM Robotics principles represent an approach to robot creation that is based on the biological principles of behavior of living organisms. In the context of the Industry 5.0 concept, these principles can be considered from the point of view of their applicability and compliance with the goals of sustainable and human-oriented industrial development:

- the Biological principle aims to create robots whose design and behavior are modeled after living organisms. This principle corresponds to the Industry 5.0 idea of creating technologies that promote harmonious interaction with the environment and nature;

- the Emergent principle states that complex robot behavior can arise from simple interactions between individual components. This principle caters for Industry 5.0's striving to create intelligent systems that can adapt to changing conditions without human intervention;

- the Adaptive principle emphasizes the robot's ability to adapt its behavior to changing environmental conditions. This principle meets the Industry 5.0 requirements for creating flexible and sustainable manufacturing systems;

- the Morphological computation principle provides robots with the ability to use their physical structure to perform computational tasks. This principle corresponds to the Industry 5.0 concept of creating intelligent manufacturing systems capable of self-organization and adaptation to change;

- the Low power principle strives for energy efficiency by using a minimal amount of energy for its work. This principle corresponds to the requirements of Industry 5.0 to create environmentally friendly and energy – efficient technologies.

BEAM Robotics principles can contribute to the creation of intelligent and efficient robots capable of interacting with humans and the environment in accordance with the concepts of Industry 5.0.

During the research, a comparative analysis of Isaac Asimov's Laws of Robotics and BEAM Robotics was carried out in terms of orientation, purpose, priorities, interaction, restrictions, self-preservation. The results of the analysis are presented in Table 1.

Table 1 - Comparative analysis of Isaac Asimov's Laws of Robotics and BEAM Robotics

Category	Asimov's Three Laws	BEAM Robotics Principles
Focus	For human protection and safety	For naturalness and effectiveness
Target	Preventing harm to humans	Modeling of biological processes
Priorities	Human safety comes first	Efficiency and adaptability
Interaction	Robots should serve humanity	Robots must adapt to their environment
Restrictions	Robots should not harm humans	Robots must use resources efficiently
Self-preservation	Robots must ensure their own safety	Robots must be energy – efficient

By analyzing the comparison table of Isaac Asimov's Laws of Robotics and BEAM Robotics Principles from an ethical perspective in the context of the Industry 5.0 concept, the following conclusions can be drawn. First, Asimov's laws, which focus on protecting people and preventing harm are consistent with the Industry 5.0's goal to safe and human-centered technology use. At the same time, BEAM robotics principles such as adaptability and energy efficiency support the goals of sustainable development and energy efficiency within Industry 5.0. However, from an ethical point of view, there are potential challenges in implementing these principles in practice. For example, the principle of emergence in BEAM robotics can lead to unexpected consequences that may violate ethical principles. Therefore, the implementation of robotics within Industry 5.0 requires a balance between innovation and ethical norms to ensure safety, sustainability, and human-centered development.

CONCLUSIONS. In conclusion, it can be noted that the comparison of Isaac Asimov's laws of robotics and BEAM robotics principles allows for a better understanding of different approaches to regulating robot behavior. Asimov's laws focus on protecting humans and preventing harm, which is relevant in the context of rapid technological development and the introduction of robots into various spheres of activity. BEAM robotics principles, in turn, strive to create more natural and efficient systems by modeling robot behavior after living organisms. Both approaches have their advantages and disadvantages, and it is important to consider them when developing ethical standards for the use of robotics in the future. Further research in this area can contribute to the creation of safer, more efficient, and ethical robotics that corresponds to the principles of sustainable development and human-centeredness in industry.

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