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**SPATIAL GRASP MODEL FOR DISTRIBUTED MANAGEMENT AND ITS
COMPARISON WITH TRADITIONAL ALGORITHMS**

(New book summary)

**ВИКОРИСТАННЯ МОДЕЛІ ПРОСТОРОВОГО ЗАХОПЛЕННЯ ДЛЯ
РОЗПОДІЛЕНОГО УПРАВЛІННЯ ТА ЇЇ ПОРІВНЯННЯ З ТРАДИЦІЙНИМИ
АЛГОРИТМАМИ**

(Короткий зміст нової книжки)

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Анотація. Слово «просторовий» фундаментально пов'язано з людським існуванням та діяльністю в будь-якому земному, а тепер навіть небесному просторі. Мета цієї книжки полягає в описі використання універсальної високорівневої моделі та технології для роботи з просторовими системами різної природи. Після розгляду просторових особливостей багатьох сфер книжка описує основи високорівневої Технології просторового захоплення, пояснює, як вона може застосовуватися у великих розподілених системах, а також розглядає Мову просторового захоплення (МПЗ), яка може забезпечити просторове бачення, усвідомлення, управління та навіть свідомість. У роботі демонструється, як прописані за допомогою МПЗ сценарії самостійно розвиваються у фізичних, віртуальних або уявних просторах, а також показуються основні деталі реалізації технології, коли розподілений інтерпретатор МПЗ, інтегрований із системами зв'язку, може перетворити її на потужний просторовий двигун. МПЗ застосовується для опису універсальних методів бачення, розуміння та модифікації великих розподілених просторів. Наведені численні сценарії, прописані за допомогою МПЗ, відображають застосування технології в численних сферах діяльності, включаючи сектор безпеки, створення автономних роботів, забезпечення автоматичного керування та протидію кібератакам у мережесевих системах. У книжці також порівнюється модель просторового захоплення з традиційними алгоритмами, підтверджуючи її універсальність для будь-яких просторових систем, тоді як звичайні алгоритми є лише інструментами для конкретних сфер застосування. Технологія може бути впроваджена на будь-якій платформі, а її прототипи вже були створені для її попередніх версій у різних країнах.

Ключові слова: просторове бачення, просторове управління, Технологія просторового захоплення, просторові сценарії, кібератаки, розподілені алгоритми.

Abstract. The word «spatial» fundamentally relates to human existence and activity in any terrestrial and now even celestial spaces. The aim of this book is to describe a universal high-level model and technology for dealing with spatial systems of different natures. After reviewing the spatial features of many areas, the book describes the basics of high-level Spatial Grasp Technology for dealing with large distributed systems, together with its Spatial Grasp Language (SGL), which can provide spatial vision, awareness, management, and even consciousness. It shows how the SGL scenarios self-evolve in physical, virtual, or imaginable spaces, and demonstrates the main details of the technology implementation, where a distributed SGL interpreter integrated with communication systems can convert the whole into a powerful spatial engine. Universal techniques are described in SGL for vision, understanding, and modifying large distributed spaces. Provided numerous SGL scenarios reflect application in numerous areas, including security, autonomous robots, automatic control, and withstanding cyberattacks in networked systems. The book also compares the Spatial Grasp model with traditional algorithms, confirming the universality of the former for any spatial systems, with the latter just being tools for concrete applications. The technology can be implemented on any platform, which was already prototyped for its previous versions in different countries.

Keywords: *spatial vision, spatial control, Spatial Grasp Technology, spatial scenarios, cyberattacks, distributed algorithms.*

What it is about in one sentence: The book describes high-level model, technology, and language for effective dealing with large distributed dynamic spaces of different natures, and also compares the new paradigm with the traditional algorithms.

Book contents

1. Introduction

The humankind exists, operates, and develops in large distributed spaces, where “spatial” may be considered as the basic feature philosophically, conceptually, and practically. The aim of this book is to describe a universal high-level model and technology for dealing with spatial systems of different natures and show the advantages of the offered spatial paradigm over traditional algorithms. A summary of the book contents and the used publication sources are provided.

2. «Spatial» as the basic feature of human activity

This chapter reviews «spatial» as a basic feature of human activity, including spatial temporal analysis, space-time continuum, spatial analysis, spatial vision, spatial feeling, spatial understanding, spatial awareness, spatial consciousness, spatial ability, spatial intelligence, spatial knowledge, spatial danger, spatial warfare, spatial management, spatial planning, spatial belief, spatial faith, spatial hate, spatial crime, spatial diversity, spatial hope, and even spatial virus.

3. Spatial Grasp Model and Technology (SGT)

Within SGT, high-level operational scenarios in recursive Spatial Grasp Language (SGL) starting at any world point effectively propagate, cover, and match the distributed environment in a parallel wave-like mode. Communicating SGL interpreters (up to thousands and even billions of copies if needed) effectively integrated with advanced communication systems may altogether represent powerful spatial engines operating without central management, often vulnerable in complex and unpredictable situations.

4. Spatial Grasp Language (SGL) features

SGL allows us to represent high-level and complex spatial operations in a very clear and compact manner in comparison with traditional programming models and languages, with the feeling of staying in open spaces directly. Basic SGL features are summarized, including its universal rules, physical or virtual constants, and unique spatial variables (some mobile ones), which include global, heritable, frontal, nodal, and environmental ones. The main mechanisms of spatial interpretation of the language constructs are also described.

5. Representing physical and virtual spaces in SGL

Representing different features of large distributed spaces in SGL are analyzed, and some specific methods and mechanisms of spatial vision, penetration, navigation, and management are offered. These include reaching different points selectively or simultaneously, movement in between, finding optimal coverage, the shortest paths, discovering certain shapes, outlining the needed parts of space or its whole, peculiarities of operation in combined physical, virtual, and imaginable continuum, etc.

6. Examples of spatial management in different areas

Examples of typical solutions in SGL for distributed dynamic systems are described. These include finding the shortest path tree (SPT) from a node to all other nodes and the shortest path be-

tween two nodes, finding and collecting information on certain individuals worldwide identified by specific features, defining how the team of chasers fights multiple targets under dynamically supported global awareness in the team, using self-evolving spatial patterns for recognizing and reacting on unpredictable situations like in industry, security, or battlefield, etc.

7. Cybersecurity applications of SGT

Cybersecurity is the practice of protecting systems, networks, and programs from digital attacks. Implementing effective cybersecurity measures is particularly challenging today because there are more devices than people, and attackers are becoming more innovative. After reviewing typical internet cyberattacks, some concrete scenarios are provided for discovering virus sources in distributed networks by accidental records in nodes mentioning neighbors from which the infection came or by the infection arrival time in nodes.

8. Spatial Grasp Model versus the concept of algorithm

Algorithm is usually a finite sequence of mathematically rigorous instructions used to solve a class of specific problems or to perform a computation. A review of definitions of algorithm and its existing extensions is provided, including distributed, spatial analysis, and mobile agents. In comparison with the SG model, traditional algorithms are just specific tools for solving specific problems, whereas SG integrating spatial philosophy and technology can be effectively used for managing any world (Ref: “spatial grasp” in google.com).

9. Conclusions

The results of this book can be used for the development of advanced technologies for dealing with large and complex terrestrial and celestial systems, as well as radically new spatially-oriented teaching and research courses and programs at universities and academic research institutions. The SG technology can be easily and quickly implemented on any platform, which was already investigated and prototyped for its previous versions in different countries.

REFERENCES

These include reviewed, combined, and topically grouped sources used in different chapters.

Previous publications

- Sapaty P.S. A distributed processing system, European Patent N 0389655, Publ. 10.11.93, European Patent Office.
- Sapaty P.S. Mobile Processing in Distributed and Open Environments. New York: John Wiley & Sons, 1999.
- Sapaty P.S. Ruling Distributed Dynamic Worlds. New York: John Wiley & Sons, 2005.
- Sapaty P.S. Managing Distributed Dynamic Systems with Spatial Grasp Technology. Springer, 2017.
- Sapaty P.S. Holistic Analysis and Management of Distributed Social Systems. Springer, 2018.
- Sapaty P.S. Complexity in International Security: A Holistic Spatial Approach. Emerald Publishing, 2019.
- Sapaty P.S. Symbiosis of Real and Simulated Worlds under Spatial Grasp Technology. Springer, 2021.
- Sapaty P.S. Spatial Grasp as a Model for Space-Based Control and Management Systems. CRC Press, 2022.
- Sapaty P.S. The Spatial Grasp Model: Applications and Investigations of Distributed Dynamic Worlds. Emerald Publishing, 2023.
- Sapaty P.S. Providing Integrity, Awareness, and Consciousness in Distributed Dynamic Systems. CRC Press, 2024.
- Sapaty P.S. Spatial Networking in the United Physical, Virtual, and Mental World. Springer, 2024.
- Sapaty P.S. Self-Healing and Self-Recovering Systems under the Spatial Grasp Model. Emerald Publishing Limited, 2025.

Related titles in this field

Eysenck M.W., Brysbaert M. Fundamentals of Cognition. Routledge, February 14, 2018. ISBN-10: 113867043X.

Renz J. Qualitative Spatial Reasoning with Topological Information. Lecture Notes in Computer Science, 2293. Springer, February 27, 2002. ISBN-10: 3540433465.

Shkutsko A.N., Semyachkov K.A. Emerging Frontiers in Spatial Development, Economic Integration, and Innovation Ecosystems: Research Anthology and Selected Contributions. Independently published, February 19, 2025. ISBN-13: 979-8311345224.

Wieder S., Wachs H. Visual/Spatial Portals to Thinking, Feeling and Movement: Advancing Competencies and Emotional Development in Children with Learning and Autism Spectrum Disorders. Profectum Foundation, December 23, 2012. ISBN-10: 0578111284.

Drewello H., Scholl B. Integrated Spatial and Transport Infrastructure Development: The Case of the European North-South Corridor Rotterdam-Genoa (Contributions to Economics). Springer, September 28, 2015. ISBN-10: 3319157078.

Dixon B. Interdisciplinary Environmental Solutions: Using Geospatial Technologies for Bridging Disciplines, Scale and Data. Palgrave Macmillan, July 25, 2025. ISBN-10: 3031167627.

Gold C. Spatial Context: An Introduction to Fundamental Computer Algorithms for Spatial Analysis (ISPRS Book Series 12). CRC Press, April 17, 2018. ISBN-13: 978-1498779104.

How will the book differ from them?

It covers them all by offering an integral theoretical and practical approach suitable for solving the mentioned and much broader problems under spatial vision, awareness, and even consciousness.

What new perspective will it offer?

It offers a unified approach for dealing with any types of spatial systems, both terrestrial and celestial, by combining philosophy, theory, technology and solutions for their effective investigation, management, and control.

Who is the primary market for this title?

Universities, research centers, defense and military institutions, space control, international cooperation.

List of markets for this title

Space economy, space traffic management, space infrastructures, etc.

What societies, professional bodies, etc. are interested in this field?

Spatial Statistics Society, Spatial Econometrics Association, European Society for Spatial Biology, Geospatial Council of Australia, etc.

What conferences, events, symposia, etc. take place in this field?

The European Space Forum 2025, 21st European Space Mechanisms and Tribology Symposium 2025, SpaceTechExpo-Europe 2025, Spatial Data Science Conference 2025 in London and New York, CNG (Cloud-Native Geospatial) Conference 2025, etc.

What publications, sites, blogs, etc. might be interested in this book?

European Journal of Spatial Development, Journal of Spatial Science. The Spatial Web, Spatial Corp Blog, AWS Spatial Computing Blog, etc.

Estimated word count: 45,000 words.