



Anti-Geometry and NeutroGeometry Characterization of Non-Euclidean Data

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Abstract:

Recently, a problem is addressed while dealing with fourth dimensional or non-Euclidean data sets. These are the data sets does not follow one of the postulates established by Euclid specially the parallel postulates. In this case, the precise representation of these data sets is major issues for knowledge processing tasks. Hence, the current paper tried to introduce some non-Euclidean geometry or Anti-Geometry methods and its examples for various applications.

Keywords: Antigedometry; Euclidean geometry; Graph Analytics; Knowledge representation; Multi-attributes; NeutroGeometry, Non-Euclidean geometry

1. INTRODUCTION

The mathematical representation of data and its visualization in given (x, y) - co-ordinate is one of the most crucial tasks for the data science researchers[1-2]. It becomes somewhat easier after the Euclidean geometry¹. This geometry provided five postulates as given below [3]:

1. A straight line can be drawn from any given two points.
2. A finite length straight line can be drawn continuously in a straight line,
3. A circle can be drawn from a given point using any radius,
4. Each of right angles in the given plane is equal to each others,

5. The last one is parallel postulates which says that, one and only one parallel line can be drawn from a point not lie on the straight line.

There are several applications of Euclidean geometry due to its constructive nature. One of the famous results is triangle angle sum i.e. 180° as shown in Figure 1.

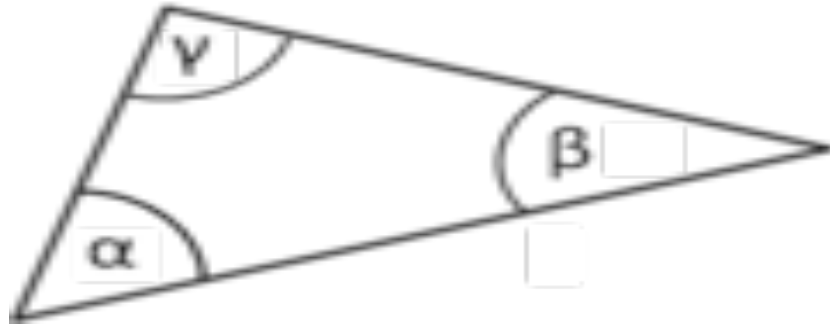


Figure 1: The sum of angle in the given triangle is 180° as per Euclidean geometry

The problem arises while dealing the human cognition and its quantum state which depends on conscious and unconscious mind using Shunyata theory of Nāgārjuna²⁻³. It states two truths rather than one of Euclidean geometry which can be produced as follows:

- (i) They can be produced by themselves, or
- (ii) They can be produced from other things, or
- (iii) They can be produced from both themselves and from other things, or
- (iv) They cannot be produced in any other ways.

In similar ways Gauss (1775-1855), Lobachevsky (1792-1856), Bolyai (1802-1860), and B. Riemann (1826-1866) thought about the fifth postulate using its negation for data representation⁴ as shown in Figure 2⁵⁻⁷ [4]. It is defined as Smarandache geometry [5-7]. Recently this theory is extensively studied using NeutroAlgebra [8-10] to visualize them via Neutrogeometry [11-14].

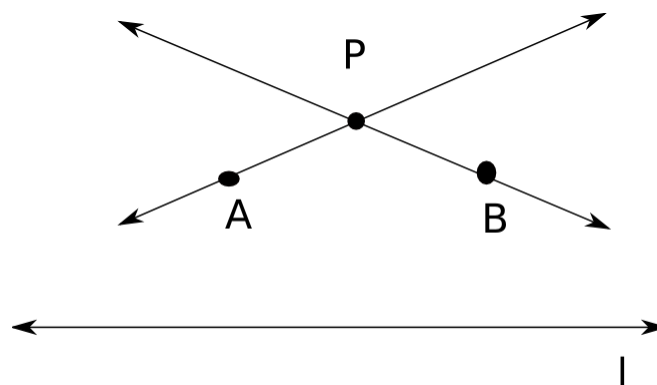


Figure 2: The negation of Euclid Fifth Postulates i.e. Parallel Postulates

It means the motion of any elements depend on the human cognition and its Turiyam state which cannot be decided without space and time connection [12]. These types of non-commutative geometry (where multiplication is not commutative) requires a four-dimensional or quantum space rather than Euclidean geometry⁸⁻⁹. The applications of non-Euclidean geometry is also required while hierarchical order visualization of any real life data sets like AQI measurement in particular areas [13]. In this case many regions may contain same AQI based on its longitude and latitude as per spherical space. In this case, the precise analysis of AQI and its impact based on vertex of graph or tree requires exponential (2^n) space for the given n regions. To achieve this goal, this paper tried to focus on introducing some new concepts of Non-Euclidean geometry and its real life examples for further study.

Other parts are structured as follows: Section 2 provides some data with Non-Euclidean geometry and its visualization. Section 3 proposed a method for NeutroGeometry characterization of Non-Euclidean data. Section 4 provides some of the real life examples for Non-Euclidean geometry and its applications in Knowledge processing tasks. Section 5 provides conclusions followed acknowledgement by references.

2. NON-EUCLIDEAN GEOMETRY

In this section, some distinct geometry and its visualization is shown for understanding the Non-Euclidean data:

Definition 1. (Types of Geometry) [14-15]: The first issue arises with any researchers about difference among Euclidean and Non-Euclidean geometry and its visualization. To achieve this goal, Hyperbolic, Euclidean and Elliptic geometry as shown in Figure 3. The next some examples and applications of Non-Euclidean geometry with its partial visualization is shown below¹⁻⁵:

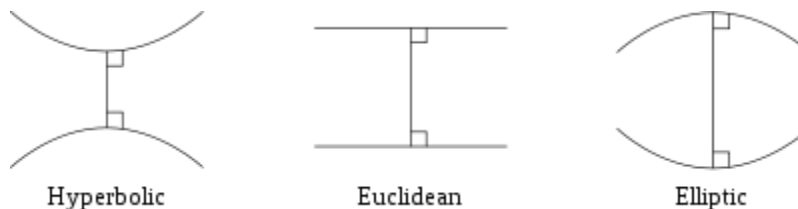


Figure 3: The difference among Euclidean and Non-Euclidean geometry (Hyperbolic and Elliptic)

Definition 2. (Spherical Geometry) [16]: It is geometry of solid. In this geometry the triangle postulates as well as Pythagorean theorem fails as shown in Figure 4. The sum of angle of a triangle in spherical geometry is not 180° .

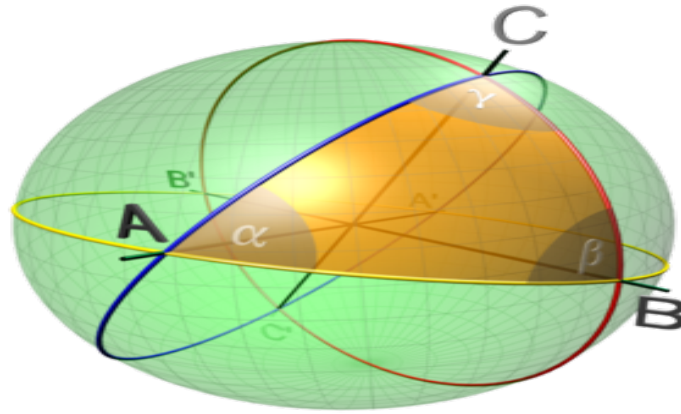


Figure 4: The examples for the negation of Figure 1 of Euclidean Geometry

Definition 3. (HyperGeometry) [17]: it provides the failure of parallel postulates that many line can be drawn from a point outside the given line. Same time the in hyperbolic geometry rectangles differ from Euclidean rectangles as shown in Figure 5. It means this geometry contains more saddle point which looks like equilibrium. This type of geometry is helpful in finding hetero clinic orbital path and periodic strings in the given language.

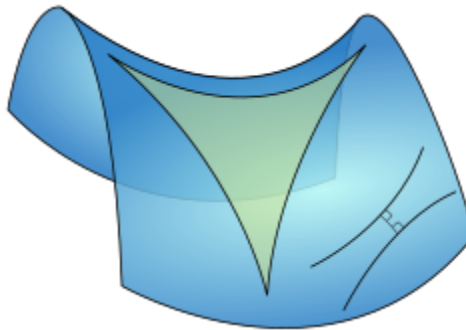


Figure 5: A triangle immersed in hyperbolic paraboloid with two diverging ultra-parallel lines¹¹

How to deal these types of physical phenomenon and characterize them in true, false or uncertain regions is one of the most crucial tasks. In the next section a method is proposed to deal with these types of data in NeutroGeometry for multi-decision process.

3. A PROPOSED METHOD FOR NEUTROGEOMETRY or ANTI-GEOMETRY CHARACTERIZATION

In this section a method is proposed to for characterization of Non-Euclidean data in true, false and

NeuroGeometry as follows:

Step 1. Let us consider the data with non-Euclidean geometry which does not follow any one of the Euclidean postulates.

Step 2. Let A be any non-empty set of a given Non-Euclidean geometrical data

Step 3. Define the Neuro operator as $\circ: A \times A \rightarrow P^n(A)$ As $(T, I, F) \notin \{(1, 0, 0), (0, 0, 1)\}$.

Step 4. In case this type of map possible then characterize them as follows:

- (i) In case any element of $x, y \in A$ non-Euclidean geometry provides a new element in Non-Euclidean geometry i.e. $x \circ y \subseteq A$. It can be considered as true characterization.
- (ii) In case any element of $x, y \in A$ non-Euclidean geometry provides a new element which does not exists in the Non-Euclidean geometry using the given operator as $x \circ y \not\subseteq A$. It can be considered as false regions.
- (iii) In case any element of $x, y \in A$ non-Euclidean geometry provides a new element which in saddle space and its quantum state is uncertain. This type of element can be considered in NeuroGeometry .

Step 5. In this way case the NeuroGeometry will help while adequate characterization of uncertainty in given Non-Euclidean data sets and its analysis using NeuroAlgebra.

4. SOME APPLICATIONS OF DATA WITH NEUTROGEOMETRY

In this section, some real life examples is discussed for NeuroGeometry as follows:

Example 1. (Astronomy)¹³: The precise analysis of astronomy, or positional astronomy is a branch of data with Non-Euclidean geometry. It used to locate any astronomical objects on the celestial sphere for the given date, time, and its spatial location on the Earth. The mathematical representation of astronomy and its pattern is based on spherical geometry and its algebra as shown in Figure 6. In this way, the Superior planets may have a larger orbit when compared to inferior planets as per spherical geometry. It means the transit may occur in case the inferior planet passes through the given point of conjunction. It means the place of any object in the sky and its pattern can be found.

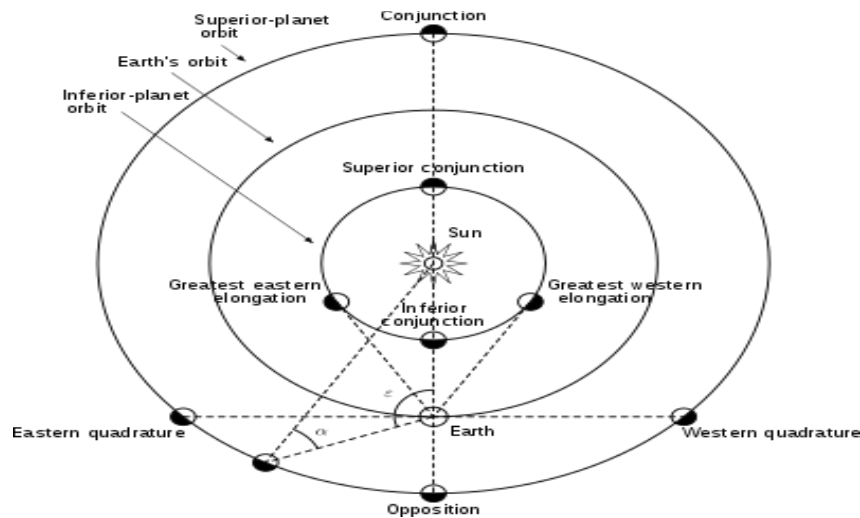


Figure 6: A Non-Euclidean diagram for positional Astronomy

Example 2. (Surface growth)¹³: There are many number of processes which defines the surface growth. It will provide growth of gravitational bodies, plants [18], nanostructures, and its phase transitions are one of the suitable examples. Even 3D printing, and cell mobility are also an example of non-Euclidean geometry. All of these cases are can be represented using the Riemannian geometry i.e. time and space dependent curvature.

Example 3. (NeutroLaws) [11-12, 19]: The law in any country is totally uncertain and vague. It depends on hierarchical ordering of citizens and its positional power in the given country which is non-Euclidean data rather than flat. There are several cases where same punishment will not given to each citizen for same act. It can be defined as follows:

- (i) Law (1, 0, 0): In case the given law is fully applied on the particular citizen. In this case the government or court can be considered as unbiased.
- (ii) Anti-Law (0, 0, 1): In this case there is no law defined for the particular act. It used to be observed when a politician or business class people never get punishment under same law.
- (iii) NeutroLaw (t, i, f). In this case the law changes based on person to person, region to region, religion to religion. This type of law where partial influenced occur by any government or higher authority can be considered as NeutroLaw. The hidden pattern in these types of data can be analyzed using Non-Euclidean geometry.

Example 4. (Neutro Citation) [12-13, 20]: The characterization of citation for intellectual measurement cannot be done via flat way like Euclidean geometry. It requires non-Euclidean classification as follows:

- (i) Citation (1, 0, 0): A paper cited by the domain expert, keyword or methodology matching for the given topic can be considered as relevant citation (1, 0, 0).

- (ii) Anti-Citation (0, 0, 1): A paper cited in irrelevant way, a retracted paper citation, a posthumous authors papers citation, same departmental citations beyond the relevant of topic, host conference citation without relevancy, forced citation, random citation can be considered as Anti-Citation(0, 0, 1).
- (iii) NeutroCitation(t, i, f): A paper which is cited with interdisciplinary, collaboration, self-citations, influenced citations, honors citations, editorial citation, journal citations etc. can be considered as Neutro-citation (t, i, f).

Example 5. (Brain Drain Analysis) [21]: The brain drain and its parameter can not be defined as Euclidean space. It happens parallel when conflict arises with the given boss or management. In this case, many intellectual leave the organization at same time in parallel way. The problem arises when many authors published the documents in given domain. In this case precise analysis of brain drain become difficult for the organization which can be characterized as follows:

- (i) Brain Drain (1, 0, 0): In case the authors having many papers in chosen research domain with highly citation left the organization can be considered as brain drain. This provide a pattern that the management does not cares about brain drain when all the authors left the organization.
- (ii) Anti-Brain Drain (0, 0, 1): The authors who published the paper using Posthumous authors papers to claim as real author of the given areas and left the organization can be considered as Anti-brain drain [22]. Same time the authors who has not published any papers in the given domain and left the organization can be characterized as Anti-Brain Drain (0, 0, 1). This will provide a pattern about policy of management when all the authors having no papers left the organization.
- (iii) Neutro Brain Drain (t, i, f): This problem arises when multiple authors papers are available in the given domain. Same time the author publishes several research papers in different domain as interdisciplinary. Same time the author whose papers retracted from the given journal due to some issues. The collaborative work and non-journal publications can be considered as NeutroPublications. These types of data can be categorizes as Neutro Brain Drain. It needs more metric and depth analysis like work pressure, less salary, promotions or other issues arises.

In this case the Non-Euclidean geometry may provide a new metric for brain drain analysis which based on human cognition and its orientation. Each people who left the organization they have same angle of parallelism as non-intersecting conflict to leave the organization. It can be represented using Non-Euclidean geometry as shown in Figure 7. Hence these types of human cognition can be represented using spherical geometry radius as intellectual which inclination towards academic as polar and inclination as research as azimuthal angle. It can also analyzed as work load considering as radius based on salary and positional inclination as polar and azimuthal angle, respectively shown in Figure 8. In near future the author will focus on exploring these areas of research for multi-decision process.

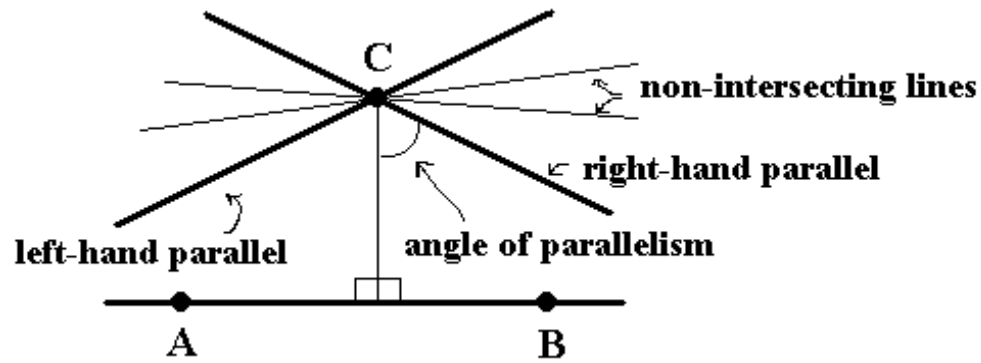


Figure 7: A Non-Euclidean geometry which shows parallel postulates

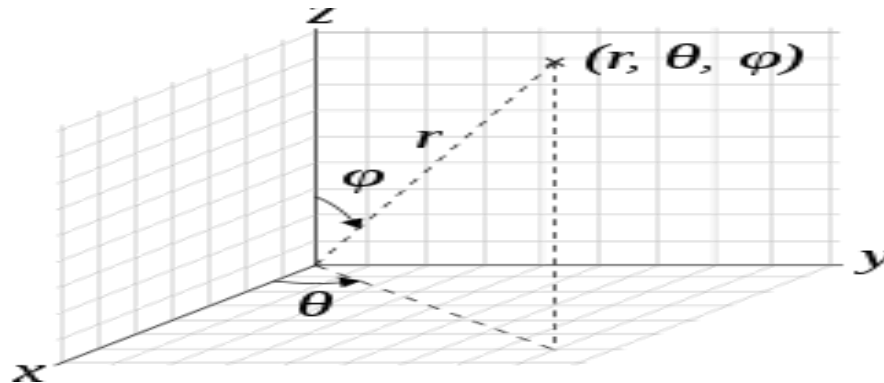


Figure 8: The spherical data representation using radius, polar and azimuthal angle

5. CONCLUSIONS

This paper explores the non-Euclidean data sets and its characterization in NeutroGeometry. A method is proposed to characterize the given Non-Euclidean data sets in NeutroGeometry. Some of the real life examples for Non-Euclidean data sets are discussed in Section 4. In near future, the author will focus on exploring this area for characterization of Non-Euclidean geometrical data sets and its cluster for knowledge processing tasks.

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Conflicts of Interest: Author declares that, there is no conflict of interest for the given paper.

Ethics approval: This article does not contain any studies with human or animals participants.

Footnotes:

1. https://en.wikipedia.org/wiki/Euclidean_geometry
2. <https://en.wikipedia.org/wiki/Nagarjuna>
3. <https://en.wikipedia.org/wiki/Nagarjuna>
4. <https://www.cut-the-knot.org/triangle/pythpar/Drama.shtml>
5. https://en.wikipedia.org/wiki/Nikolai_Lobachevsky
6. <https://dawn.cs.stanford.edu/2019/10/10/noneuclidean/>
7. https://en.wikipedia.org/wiki/Non-Euclidean_geometry
8. https://marcocetica.com/posts/non_euclidean_geometry/
9. https://en.wikipedia.org/wiki/Noncommutative_geometry
10. https://en.wikipedia.org/wiki/Spherical_astronomy
11. https://en.wikipedia.org/wiki/Hyperbolic_geometry
12. https://en.wikipedia.org/wiki/Spherical_astronomy
13. https://en.wikipedia.org/wiki/Non-Euclidean_surface_growth

References:

- [1] Singh P.K., “Turiyam set a fourth dimension data representation. Journal of Applied Mathematics and Physics, Vol. 9, Issue 7, pp. 1821-1828, 2021, DOI: [10.4236/jamp.2021.97116](https://doi.org/10.4236/jamp.2021.97116)
- [1] Singh P.K., “Fourth dimension data representation and its analysis using Turiyam Context”. Journal of Computer and Communications, Vol. 9, Issue 6, pp. 222-229, 2021 doi: [10.4236/jcc.2021.96014](https://doi.org/10.4236/jcc.2021.96014)
- [2] Birkhoff G.D., “A Set of Postulates for Plane Geometry (Based on Scale and Protractors)”. Annals of Mathematics, Vol. 33, 1932.
- [3] Lobachevsky N., “Pangeometry, Translator and Editor: A. Papadopoulos. Heritage of European Mathematics Series". European Mathematical Society, Vol. 4, 2010.
- [4] Bhattacharya S., “A model to a Smarandache Geometry”. 2004, <http://fs.unm.edu/ModelToSmarandacheGeometry.pdf>
- [5] Popov, M. R., “The Smarandache Non-Geometry. Abstracts of Papers Presented to the American Mathematical Society Meetings, Vol. 17, Issue 3, pp. 595, 1996.
- [6] Kuciuk L., Antholy M., “An introduction to the Smarandache geometries. JP Journal of Geometry & Topology”, Vol. 5, Issue 1, 77-81, 2005, <http://fs.unm.edu/IntrodSmGeom.pdf>
- [7] Smarandache F., “Introduction to NeutroAlgebraic Structures and AntiAlgebraic Structures”. In: Advances of Standard and Nonstandard Neutrosophic Theories, Pons Publishing House Brussels, Belgium, Vol. 6, pp. 240-265, 2019. <http://fs.unm.edu/AdvancesOfStandardAndNonstandard.pdf>
- [8] Smarandache F., “NeutroAlgebra is a Generalization of Partial Algebra”. International Journal of Neutrosophic Science, Vol. 2, pp. 8-17, 2020. DOI: [http://doi.org/10.5281/zenodo.3989285](https://doi.org/10.5281/zenodo.3989285)

- [9] Al-Tahan M., Smarandache F., Davvaz B., “NeutroOrderedAlgebra: Applications to semigroups”. *Neutrosophic Sets and System*, Vol. 39, pp. 133–147, 2021.
- [10] Smarandache F., “NeutroGeometry & AntiGeometry are alternatives and generalizations of the Non-Euclidean Geometries”. *Neutrosophic Sets and Systems*, Vol. 46, pp. 456-476, 2021. <http://fs.unm.edu/NSS/NeutroGeometryAntiGeometry31.pdf>
- [11] Singh P. K., “NeutroAlgebra and NeutroGeometry for Dealing Heteroclinic Patterns”. In: *Theory and Applications of NeutroAlgebras as Generalizations of Classical Algebras*, IGI Global Publishers, 2021, (Accepted for Publications)
- [12] Singh P. K., “Data with Turiyam Set for Fourth Dimension Quantum Information Processing”. *Journal of Neutrosophic and Fuzzy Systems*, Vol 1, Issue 1, pp. 9-23, 2021.
- [13] Singh P. K., “Air Quality Index Analysis Using Single-Valued Neutrosophic Plithogenic Graph for Multi-Decision Process”. *International Journal of Neutrosophic Sciences*, Vol 16, Issue 1, pp. 28-141, 2021. DOI: <https://doi.org/10.54216/IJNS.160103>
- [14] Russell B., “Introduction: An essay on the foundations of geometry”. Cambridge University Press, 1897.
- [15] Coxeter H.S.M., “Non-Euclidean Geometry. University of Toronto Press, 1942. reissued 1998 by Mathematical Association of America.
- [16] James A. W., “Hyperbolic Geometry”. Second edition 2005, Springer.
- [17] Pandey L. K., Ojha K. K., Singh P.K., Singh C. S., Dwivedi S., Bergey E.A, “Diatoms image database of India (DIDI): a research tool”. *Environmental Technology & Innovation*, Vol. 5, pp. 148-160, 2016. <https://doi.org/10.1016/j.eti.2017.02.005>
- [18] Kapoor P, Singh P. K., Ch. Aswani Kumar, “IT act Crime Pattern Analysis Using Regression and Correlation Matrix. In: *Proceedings of 8th International Conference on Reliability, Infocom Technologies and Optimization 2020*, pp. 1102-1106, 2020. doi: 10.1109/ICRITO48877.2020.9197835
- [19] Tixeira da Silva J.A., Vuong Q.H., “The right to refuse unwanted citations: rethinking the culture of science around the citation”. *Scientometrics*, Vol. 126, pp. 5355–5360, 2021.
- [21] Subbotin A., Aref S., “Brain drain and brain gain in Russia: Analyzing international migration of researchers by discipline using Scopus bibliometric data 1996–2020”. *Scientometrics*, Vol. 126 pp. 7875–7900, 2021 <https://doi.org/10.1007/s11192-021-04091-x>
- [22] Kosmulski M., “Posthumous co–authorship revisited”. *Scientometrics*, Vol. 126, pp. 8227– 8231, 2021