 

doi:10.20312/dim.2018.06

# Mathematical model for describing the universe

**István Bán**
Retired Forestry Engineer and Applied Mathematician
istvan.ban.dr@gmail.com

***In remembrance of Stephen Hawking***

ÖSSZEFOGLALÓ. Az univerzum az észlelhető-, tudottan létező, de nem észlelhető- és általunk elképzelhetetlen állapotjellemző értékek, relációk és mindezek sajátosságainak összességéből áll. Az univerzum kialakulásában nagy szerepe lehet az úgy nevetett PMSB matematikai modellen.

ABSTRACT. Natural phenomena consist of the entirety of the following: existent and known state characteristics and their values; existent but unknown state characteristics and their values; state characteristics inconceivable by us and their values; existent and known relations as well as relation features; existent but unknown relations and relation features, relations and relation features inconceivable by us.
We assume that the entirety of the above creates objects by existing organising principles, with these objects constituting non-empty subsets of a certain entirety of natural phenomena. Creation may also happen with the so-called PMSB method. The PMSB method is of very high significance for calculating optima in expert systems. The entirety of past, present and future natural phenomena constitutes the universe.

## 1. Introduction

Man has always been interested in the universe. Today, a number of new discoveries is made with the help of space probes. Geysers were detected on the surface of Sirius. On Mars and Saturn, organic molecules were found. On the moon, signs of water were discovered. Nearly all scientific disciplines turn towards the universe, and this is true for mathematics as well.

## 2. Extending state characteristics in the universe

Be all the possible state characteristic values of the states occurring in nature $(a_{1,n}, a_{2,n}, a_{3,n}, \dots, a_{i,n})$, where $i = 1, 2, \dots$ is the index of the state characteristic, $n = 1, 2, \dots$ is the indicating index of the observed value ([1], pp. 16–23; [2], pp. 14–36; [9], pp. 16–33; [10], p. 41), where in case of $i_0$ and $n_0$ the state characteristics and values are known, in case of $\underline{i}$ and $\underline{n}$ a different part is existent but unknown, in case of $\propto = i - (i_0 + \underline{i})$ and $\beta = n - (n_0 + \underline{n})$, the remaining part is inconceivable and

$$i_0 \subset i,\ n_0 \subset n,\ \underline{i} \subset i,\ \underline{n} \subset n,$$

KULCSSZAVAK. Az univerzum matematikai modellje, PMSB, Hawking.
KEYWORDS. Mathematical model of the universe, PMSB, Hawking.

$$i_0 + \underline{i} +/\ i - (i_0 + \underline{i})/= i, \quad n_0 + \underline{n} +/n - (n_0 + \underline{n})/= n,$$

$$\left(\bigcup_{\forall i_0 n_0} a_{i_0 0 n_0}\right) \bigcup \left(\bigcup_{\forall \underline{in}} a_{\underline{in}}\right) \bigcup \left(\bigcup_{\forall \alpha\beta} a_{\alpha\beta}\right) = \bigcup_{\forall in} a_{in}$$

**Definition 2.1.** Out of all the possible state characteristic values the state characteristic values observed within the possibilities given by the observation system should be:

$$(a_{1,\,m}, a_{2,\,m}, a_{3,\,m}, \ldots, a_{j,\,m}),$$

where $j \leq i, m \leq n$.

**Definition 2.2.** Relation means the arbitrary adequacy between the state characteristic values.

The following types of relations between state characteristics must be distinguished: relations that correspond theoretically to all combinatorial possibilities among the state characteristics above, relations existing in reality, and relations perceivable within the possibilities of the observing system.

**Definition 2.3.** Be $b_{\mathrm{r}} = R_r\left(a_{i,\,n}\right)$ ($r = 1, 2, \ldots$) the relations corresponding to all theoretically possible combinations of the former state characteristics $\mathrm{a}_{i,\,n}$.

**Definition 2.4**. Be $b_s = R_s\left(a_{i,\,n}\right)$ ($s = 1, 2, \ldots\ n < r$) the really existing relations among the former state characteristics $\mathrm{a}_{i,\,n}$.

**Definition 2.5.** Be $b_t = R_t\,(a_{i,\,m})$ ($t = 1, 2, \ldots < s$) the relations perceivable on the basis of the possibilities of the observing system among the state characteristics $a_{i,\,m}$.

**Definition 2.6.** The peculiarities of the state characteristic values and relations detectable by mathematical methods are called specific features.

In all of the specific features deducible from the values and relations of the former state characteristics, one has to distinguish between all theoretically possible relations, the really existing features and those that can be interpreted within the possibilities of the observing system.

**Definition 2.7.** Be $F_c\left(a_{i,\,n}; R_r\left(a_{i,\,n}\right)\right)$, ($c = 1, 2, \ldots$) all the theoretically possible specific features of the state characteristics $\mathrm{a}_{i,\,n}$ and of the relations $b_r = R_r\,(a_{i,\,n})$.

**Definition 2.8.** Be $F_d\left(a_{i,\,n}; R_s\left(a_{i,\,n}\right)\right)$, ($d = 1, 2, \ldots$) the specific features existing on the basis of the state characteristics $\mathrm{a}_{i,\,n}$ and the relations $b_s = R_s\,(a_{i,\,n})$.

**Remark.** An effect is a special case of relation ([2], pp. 28–35, 256, 260; [9], pp. 27–32).

**Definition 2.9.** Be $F_e\left(a_{j,\,m}; R_t\left(a_{j,\,m}\right)\right)$, ($e = 1, 2, \ldots$) the specific features interpretable on the basis of the state characteristics $a_{j,\,m}$ and the relations $b_t = R_t\,(a_{j,\,m})$ within the possibilities of the observing system ([10], p. 42).

**Definition 2.10.** On the basis of the foregoing, the natural phenomenon $\overline{T}$ is the set of the state characteristic values $a_{i,\,n}$, $i = 1, 2, \ldots$ and $n = 1, 2, \ldots$ of all the possible relations $R_r\left(a_{i,\,n}\right)$, $r = 1, 2, \ldots$ as well as of all specific features $F_c\left(a_{i,\,n}; R_r\left(a_{i,\,n}\right)\right)$, $c = 1, 2, \ldots$, i.e.:

$$\overline{T} = \left[a_{i,\,n};\, R_r\left(a_{i,\,n}\right);\, F_c\left(a_{i,\,n};\, R_r\left(a_{i,\,n}\right)\right)\right], \qquad (1)$$

where $i = 1, 2, \ldots, n = 1, 2, \ldots, r = 1, 2, \ldots$ and $c = 1, 2, \ldots$.

**Definition 2.11.** The natural phenomenon $\overline{T}_0$ is called closed if the defining state characteristics $a_{i_0}$, the $a_{i_0,\,n_0}$ state characteristic values, the relations $R_{r_0}$ $(a_{i_0,\,n_0})$ between the state characteristics and their features $F_{c_0}$ $[a_{i_0,\,n_0};\, R_{r_0}\,(a_{i_0,\,n_0})]$ are known ([11], p. 32).

**Definition 2.12.** The entity of natural phenomena is closed if each natural phenomenon constructing it is also closed.

**Definition 2.13.** There exists a $\overline{T}_h$ natural phenomenon inconceivable by man ([11], p. 33).

**Definition 2.14.** The natural phenomenon $\overline{T}_{\rightarrow}$ is open if its defining state characteristics, state characteristic values $a_{i,\,n}$ and the relations $R_r$ $(a_{i,\,m})$ between its state characteristics are known, a part of their features $F_c$ $[a_{i,\,n};\, R_r\left(a_{i,\,n}\right)]$ is known in case of $i_0$, $n_0$, $r_0$, $c_0$, i.e. $\overline{T}_0$, a different part is existent but unknown in the cases of $\underline{i}$, $\underline{n}$, $\underline{r}$, $\underline{c}$, i.e. $\overline{T}_u$, and the remaining part is inconceivable in the cases of $i-(i_0+\underline{i})$, $n-(n_0+\underline{n})$, $r-(r_0+\underline{r})$, $c-(c_0+\underline{c})$, i.e., $\overline{T}_h$. $\overline{T}_{\rightarrow} = \overline{T}_0 \cup \overline{T}_u \cup \overline{T}_h$.

**Definition 2.15.** The entity of the natural phenomenon is open if there exists at least one natural phenomenon that is open.

**Definition 2.16.** The entirety of natural phenomena of the past, the present and the future defines $V$ (universe) ([11], p. 22), essential features of which are completeness and porousness ([11], p. 22—27).

**Definition 2.17.** The universe concept $V$ is open if it has a subset $V_h$ consisting of inconceivable natural phenomena.

**Definition 2.18.** The subset $V_u \cup V_h$ of the open universe concept $V$ which consists of $V_u$ imaginable but unknown and of $V_h$ inconceivable natural phenomena is called black hole, i.e. $BH$. $BH = V_{\mathrm{u}} \cup V_h$.

Be $V$ universe notion and $V = V_0 \cup V_u \cup V_h$, where $V_0$ is the existing known, $V_u$ the existing unknown and $V_h$ the inconceivable subset ([11], p. 36).

$V^1$ universe and $V^2$ universe are different $V^1 \neq V^2$ if $V_0^1$ and $V_0^2$ existing known universe subsets are different. Over time, we will have more and more information about $V_{\mathrm{u}}^1$ and $V_{\mathrm{u}}^2$ existing unknown and $V_{\mathrm{h}}^1$ and $V_{\mathrm{h}}^2$ inconceivable subsets that will extend $V_0^1$ and $V_0^2$ subsets.

**Definition 2.19.** The entirety $V^n$ of two or more ($n = 2, 3, \ldots, \infty$) universes that differ from each other is called multiverse $MV$.

$$MV = \bigcup_{n=2}^{\infty} V^n$$

**Definition 2.20.** It is a fact that $V$ universe has a living subset. Let its sign be L.

$$L \subset V$$

**Remark.** L living subset has an existing known subset – let its sign be $L_0$ –, has an existing unknown subset – let its sign be $L_u$ – and has an inconceivable subset – let its sign be $L_h$.

$$L = L_0 \cup L_u \cup L_h$$

The state characteristics, the values of the state characteristics, the relations and the features of the $L_0$ existing known subset are necessary but not sufficient prerequisites of life. This is true, for example, for the existence of carbon molecules. The state characteristics, the values of the state characteristics, the relations and the features of the $L_u$ existing unknown subset are special concomitants of life, the existence of which we know of, but the essence of which we do not know. This is true, for example, for the Black Bear Effect (BBE), the existence of which we know about, whilst we have no idea about its effect mechanism. ([12], pp. 7–10) Of the state characteristics, the values of the state characteristics, the relations and the features of $L_h$ inconceivable subset we do not even have a notion. Probably, these constitute the majority of the necessary and sufficient prerequisites of life.

## 3. Mathematical organisation in the universe

**Definition 3.1.** Non-empty subsets of the entirety of natural processes are called objects. Let their sign be $O$.

**Definition 3.2.** It follows from observing the universe that there are organising principles in the universe that create objects from other objects, such as the "effect" referred to in connection with relations.

It is a large blank spot in mathematical organisation that with our human concepts we are unable to give precise answers to the questions of the creation of the universe. All we can do is accept as a definition the principle of "from nothing to something".

**Definition 3.3.** All we can do is assume that there were, are and will be state characteristics and values of state characteristics inconceivable by us, that there are relations inconceivable by man between them, and all these have features inconceivable by us, the entirety of which create objects.

**Remark.** With progress in observing the universe, we get to know more and more elements of the mathematical organisation of the universe.

**Definition 3.4.** An organising principle that exists because of a particular interest or for a particular goal is called an advantageous principle ([10], pp. 42–53). The goal to be achieved is called wanted entity.

**Definition 3.5.** Of natural phenomenon $\overline{T}$ the set of states perceivable by living and non-living observation systems and of interpretable relations and deducible specific features, i.e. the wanted entity $C_\Sigma$ is ([10], p. 42), as follows from Equation (1):

$$C_\Sigma = \left[a_{j,\,m} \cup R_t\left(a_{j,\,m}\right) \cup F_e\left(a_{j,\,m}; R_t\left(a_{j,\,m}\right)\right)\right],$$

*where* $j < i$, $m < n$, $t < r$ and $e < c$.

One element of the wanted entity $C_\Sigma$ is the wanted element $C$, i.e.

$$C_{j,\,m,\,t,\,e} = \left\{\left(a_{j,\,m}\right); R_t\left(a_{j,\,m}\right); F_e\left[a_{j,\,m}; R_t\left(a_{j,\,m}\right)\right]\right\}$$

as given for a fixed, arbitrary subscript $j$, $m$, $t$, $e$.

**Consequence 3.1.** With regard to implementing an interest or goal, the optimum is the wanted entity.

**Consequence 3.2.** The optimum is the special case of the wanted entity.

**Consequence 3.3.** The optimum is the special case of the object.

**Definition 3.6.** Of all specific features determined on the basis of the known relations $R_t\,(a_{j,\,m})$ as interpreted over the values of the given state characteristics $a_{j,\,m}$, $j = 1, 2, \ldots$; $m = 1, 2, \ldots$, the most advantageous one is called *optimum* and denoted by

$$Opt_{j,\,m,\,t,\,e_0} = \{a_{j,\,m};\, R_t\left(a_{j,\,m}\right);\, F_{e_0}\left[a_{j,\,m};\, R_t\left(a_{j,\,m}\right)\right]\},\quad e_0 < e.$$

**Theorem 3.1.** *Theorem of the optimum wanted entity* ([10], p. 43): Be the state characteristic values $a_{j,\,m}$, $j = 1, 2, \ldots$ and $m = 1, 2, \ldots$.

The relations $R_t\,(a_{j,\,m})$, where $t = 1, 2, \ldots$, should be existent. The specific features detected by the mathematical methods in the state characteristic values $a_{j,\,m}$ and relations $R_t\left(a_{j,\,m}\right)$ should be

$$F_e\,[a_{j,\,m};\, R_t\left(a_{j,\,m}\right)],\quad e = 1, 2, \ldots.$$

The most advantageous specific feature should be

$$F_{e_0}\,[a_{j,\,m};\, R_t\left(a_{j,\,m}\right)],\quad e_0 \text{ is fixed} \geq 1.$$

**Statement.** The optimum wanted entity $Opt_{j,\,m,\,t,\,e_0}$ is that of the existing wanted entities that has the most advantageous specific feature.

**Proof.** [10], p. 44.

**Consequence 3.4.** The implementation of a particular interest or the achieving of a particular goal can be regarded most of all as an object optimum.

**Consequence 3.5.** In a universe set consisting of uncountable state characteristics the optimum can also be determined or achieved with the PMSB method. Thus, the realisation or coming into being of a particular object may also happen with the PMSB method.

In case of practical human application, the generalisation of the PMSB is performed by the user on the basis of his specific interest relations. In nature, the generalised wanted entity or the optimum, respectively, is determined by the mechanism of action resulting from the extended state characteristics ([1], p. 62; [2], pp. 28—35; [7], pp. 27—32).

The mechanism of action may constitute a complicated system and represents a given regularity. As already explained, it is not necessary to explore the regularity by modelling as it is represented by the entirety of the extended state characteristic values.

The existence of the advantageous principle follows from the mechanisms of action.

**Type 1 PMSB task.** Selection entity $C_{select}$ → identity entity $C_{select}$ → advantageous principle → *Opt* as the solution.

**Type 2 PMSB task.** Advantageous principle → *Opt* → entity pertaining to the entity $C_{opt}$ as the solution.

**Complex PMSB task.** The entirety of the type 1 and type 2 PMSB task, for example: partial 1 selection entity $C^1_{select}$ → identity entity $C^1_{opt}$ advantageous principle → $Opt^1$ → entity pertaining to the optimum $C^1_{opt}$ as the solution.

For that matter, there are philosophies and religions that attribute supernatural ordering principles to a certain belief or ideal, and the advantageous principle follows from it.

Since selection is planned by the advantageous principle, the method was named Planned Method of Selection, with the first letter of Bán being attached to it later as a result of its applications.

**Consequence 3.6.** Two objects, $O_1$ and $O_2$, are different or miss each other, if

$$O_1 \cap O_2 = 0.$$

**Definition 3.7.** The attribute of an object consisting in its existence is called balanced inertia.

**Definition 3.8.** An object $O_n$, $n = 1, 2, 3, \ldots, K$ is absolutely stable, if a $Q$ ($O_f$) finite fixed environment pertaining to an f fixed index exists, part of which is an $O_n$, $n = 1, 2, 3, \ldots, k$ object. The $Q$ ($O_f$) fixed environment is called limit of equalisability, $k \leq f$ ([1], pp. 14–23, 56–59, 62–65; [2], pp. 14–35, 69–72, 256–257, 260–261; [11], pp. 37–39).

Thus, $O_n \subset Q(O_f)$, $n = 1, 2, 3, \ldots, k$ and $f$ fix index $k \leq f$.

**Consequence 3.7.** Above the f fix index as so-called critical index, the given object is no longer part of the limit of equalisability, i.e., it "leaves" it, which means that it is not absolutely stable. $O_{n+m} \not\subset Q(O_f)$, $m = 1, 2, 3, \ldots, \infty$.

The $O_{n+m}$ object is called unstable or critical object ([9], p. 31).

## 4. Application in practice

The above mathematical model for describing the universe helps in choosing the most suitable strategy, determining the optimum and working out expert systems in an arbitrary subset of the universe, for example, in everyday practice.

## 5. Acknowledgements

Direct analysis of sets of states introduced half a century ago brought about a major change of approach. The first screening of any new idea, concept or method was always performed by my extraordinarily sharp-witted wife Andrea Sikos. Then I discussed the significance, the flaws, the development potential and the applicability of the algorithms with authorities in the respective fields, among them: László Bezzegh, Ferenc Béldi, Antal Bondor, Csaba Csáky, László Dala, János Fischer, Vilmos Frenyó, Csaba Forgács, Pál Gregus, Sándor Györgyi, Lajos Jánossy, Béla Keresztesi, András Madas, János Magyar, György Marx, Artúr Moór, Bálint Nagy, Ernő Nemky, Lénárd Pál, András Prékopa, Alfréd Rényi, Egon Roxer, Rezső Solymos, Gábor Soós, Albert Stasney, Sándor Szalay, Ferenc Szidarovszky, József Szőke, Kálmán Tompa, and István Vincze. I would like to thank all of them for their help and support.

I would particularly like to thank Alfréd Rényi who supported the elaboration of this method even back when it was still entirely new and regarded as unusual.

Special thanks to Piroska Draskóczy for her fast and accurate translation.

## 6. Summary

In this article, the universe is described with state characteristics, values of state characteristics, relations and their features. The existent known, existent unknown and inconceivable entirety of all these makes up the natural process. The entirety of the past, present and future natural processes constitutes the universe. For the creation of the universe, we assume the existence of the definition of “from nothing to something”, of which the PMSB method can also be a part.

## References


[1] **BÁN, István**: Új utak a növényvédelmi vizsgálatokban [New paths in plant protection investigations]. Mezőgazdasági Kiadó, Budapest, 1973, p. 275.

[2] **BÁN, István**: Biomatematika és alkalmazása a növénytermesztésben [Biomathematics and its application in plant cultivation]. Mezőgazdasági Kiadó, Budapest, 1977.

[3] **BÁN, István**: Talajerő-utánpótlási szaktanácsadás számítógéppel (Computer-aided technical consultancy on soil replenishment], in: *Magyar Mezőgazdaság*, Vol. 33 (1978), No. 33.

[4] **BÁN, István**: A kiválasztási matematikai modell felhasználása a trágyázási szaktanácsadáshoz [Using the mathematical model of selection in technical consultancy on manuring], in: *Agrokémia és Talajtan*, No. 28 (1979).

[5] **BÁN, István**, **RISKÓ, László**: Interaktív számítógépes talajerő-utánpótlási szaktanácsadó rendszer [Interactive computerised technical consultancy system on soil replenishment] (Summary of a lecture), in: *Számítástechnika*, 1979.

[6] **BÁN, István, RISKÓ, László**: Számítógépes talajerő-utánpótlás [Computerised soil replenishment], in: *Magyar Mezőgazdaság*, Vol. 34 (1979), No. 7.

[7] **BÁN, István**: A növénytermesztés szolgálatában [In service of plant cultivation], in: *Számítástechnika*, 1980.

[8] **BÁN, István**: Kiválasztási algoritmusok és alkalmazásuk az agrárgazdaságban [Selection algorithms and their application in agriculture], in: *Alkalmazott Matematikai Lapok*, Vol. 10 (1984), pp. 413—426.

[9] **BÁN, István**: Biomathematics and its Application in Plant Cultivation. Elsevier, Amsterdam – Oxford – New York – Tokyo, 1988, p. 204.

[10] **BÁN. István**: Mathematical Exploration of the Environment. Akadémiai Kiadó, Budapest, 1995, p. 116.

[11] **BÁN, István**: Biomathematics. PMSB Methods in Forestry. EP Systema Kiadó, Debrecen, 2002, p. 222.

[12] **BÁN, ISTVÁN**: Biophysics. Graphicom, Budapest, 2004, p. 200.