SYSTEM THEORY IN JAINA SCHOOL OF MATHEMATICS

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The system theory of action (*karma*) in certain Prakrit texts is exposed in the light of the recently developed mathematical system theory. The main lines on which the topic has been consolidated here are the motivation, source material, working symbols, terminology, concepts, principles, procedural illustrations, symbolic material, and cybernatics.

1. MOTIVATION

Kalman[1] and his coworkers describe the mathematical system theory as a lively, challenging, exciting, difficult, confused, rewarding, and largely unexplored field ; one which is already very important and yet holding the promise of still bigger discoveries. Practically most of the modern mathematical tools have been applied to develop this theory within the last thirty years.

For a deeper probe into the mathematical theory of *karma* of the early B. C.'s of Christian era, commented down to the eighteenth century, the comparative study with that of the present system theory has appeared to be useful. Sikdar[2] and Jain[3] have attempted to form the basis for further studies where history of action theory could find a mathematical language of controls, states, inputs, outputs, optimality, realizability, automation and various fields as well as disciplines.

As would appear from the bulk and quality of the source material, the paper could be motivated simply to render a bird's eye-view of the achievements of the Indians in formulating a unified system theory about the events and controls of intermingling sets of bios and ultimate particles of of matter, hundreds of years before the dawn of the outstanding system theory of our era.

2. CHRONOLOGY OF SOURCE MATERIAL

The source material[4] on *karma* theory in the Jaina School is available within two main traditional sects—Digambara and Svetāmbara. As the

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material in Digambara tradition has a sequential mathematical manoeuvre from *c.* second century B. C. to 1767 A. D., the proposed paper has been based on the texts available in this tradition which may be charted as below :

Period	*Contributor*	*Work*	*Abbreviation*
c. 1st cent. A. D.	Guṇadhara	*Kasāyapāhuḍa Sutta*[5] (233 verses)	*KP*
Note : Produced from the third *Pāhuḍa* '*Pejjadosa*' of the tenth *Vastu* of the fifth *Pūrva*, '*Jñāna Pravāda*' of the fourth *Aṅga* of the Scripture.			
c. 2nd cent. A. D.	Puṣpadanta and Bhūtabali	*Saṭkhaṇḍāgama*[6] including *Manābandha*	*SK* *MB*
Note : Produced from 24 *Anuyogadvāra's* of the 4th '*Karma Prakṛti*' *Prābhṛta* of the 5th *Vastu* '*Cyanalabdhi*' of the 2nd *Pūrva* '*Agrāyaṇī*' of the 4th *Pūrvagata* of twelfth *Aṅga* '*Dṛṣṭivāda*' of the Scripture.			
c. 3rd cent. A. D.	Kundakunda	(i) *Pañcāstikāya* (173 verses)	*PK*
		(ii) *Samayasāra* (415 verses)	*SS*
		(iii) *Pravacanasāra* (275 verses)[8]	*PS*
Note : Relevant topics could be found in remaining works.			
c. 3rd. cent. A. D.	Umāswāmi	*Tattvārtha Sūtra*[9]	*UTS*
c. 473. A. D.— 609 A. D.	Yativṛṣabha	(i) *Cūrṇi Sūtras* on *Kasāya-Pāhuḍa* (7009 *verses*)[10]	*KP, CS*
		(ii) *Tiloyapaṇṇattī* (5677 verses)[11]	*TP*
c. 5th cent. A.D.	Pūjyapāda	*Sarvārthasiddhi*[12] (Commentary of *Tattvārthasūtra*)	*SST*
c. 8th cent. A. D.	Akalaṅka	*Tattvārtha Rāja Vārtikam*[13]	*TRV*
c. 816 A. D.	Virasena	(i) *Dhavalā*[14] commentary of the *Saṭkhaṇḍāgama* (72000 *verses*)	*DS*
		(ii) *Jaya Dhavalā* (incomplete)[15] commentary of the *Kasāya-Pāhuḍa Sutta.* (20000 verses)	*JK*
c. 837 A. D.	Jinasena	Remaining *Jayadhavalā* commentary of the *Kasāya Pāhuda Sutta* (40000 verses)[16]	*JJK*

period	*Contributor*		*Work*	*Abbreviation*
c. 11th cent. A. D	Nemi candra	(i)	*Gommaṭasāra Jīva-Kāṇḍa* (734 verses)[17]	*GJK*
		(ii)	*Gommaṭasāra Karma-Kāṇḍa* (972 verses)[18]	*GKK*
		(iii)	*Labdhisāra* (with *Kṣapaṇāsāra* (649 verses)[19]	*LS*
		(iv)	*Trilokasāra* (1018) verses)[20]	*TS*
		(v)	*Dravyasaṃgraha* (58 verses)	*DSN*
c. 13th. cent. A. D.	Abhayacandra *Saidhāntī*		*Mandabodha Prabodhinī*[21] commentary of *Gommaṭasāra*	
c. 14th cent. A. D.	Keśava Varṇī		*Jīvatattva pradīpikā*[22] commentary of *Gommaṭasāra* (Kannaḍa) and *Labdhisāra*[23] (Sanskrit)	
c. 1203 A. D.	*Mādhavacandra Traividya*		Commentary on *Kṣapaṇāsāra* and *Trilokasāra*[24]	
c. 16th cent. A. D.	Nemicandra (Disciple of Jñanabhūṣaṇa)		*Jīvatattva pradīpikā*[25] commentary (Sanskrit)	
c. 1761 A. D.	Ṭoḍarmala of Jaipur	(i)	*Samyakjñana candrikā*[26] commentary of *Gommaṭasāra*	
		(ii)	commentary of *Labdhisāra* and *Kṣapaṇāsāra*[27]	
		(iii)	Commentary on *Trilokasāra*[28] (Based on the preceding commentaries)	

3. Working Symbols

As followed in the Prakrit texts, it is proposed to present the exposition of historical details in least possible symbols. Modern mathematical symbols will be used conventionally. Owing to their specific significance (as outlaid in earlier works of the author) the following terms shall not appear in translated form, but in original form.

Term	*Ancient*	*Synonym*	*Working Symbol*
Saṃkhyeya	णू	Numerable	*s*
Asaṃkhyeya	∂	Innumerable	*a*
Ananta	ख	Infinite	@
(The above are the ordinals)[29]			
Point Sets[30]			
Sūcyaṅgula	२	Linear finger	*F*
Jagaśreṇī	—	World-Line	*L*
Instant Sets[31]			
Atīta } *Kāla*	अ	Past (ab-aeterno)	T^-
Anāgata } *Kāla*		Future (ad-aeterno)	T^+
Vartamāna } *Kāla*		Present	T^*
Palya	प	Pit	*P*
Sāgara	सा	Sea	*C*
Āvali	२	Trail	*R*
Antarmuhūrta	२णू	Set of intervals lying within 48 minutes, greater than a trail and less than forty-eight minutes by an instant.	*Mi* or *sR*
Miscellaneous Sets[32]			
Jīva Rāśi	१६	Set of all living beings	*J*
Pudgala Rāśi	१६ख	Set of all ultimate particles	*J*@
Kāla Rāśi	१६खख	Set of all instants in all time	*J*@@
Ākāśa Rāśi	१६खखख	Set of all points in all space	*J*@@@
Abhavya Jīva Rāśi		Set of non-accomplishable living-beings	J_e-
Siddha Jīva Rāśi	३	Set of accomplishable living-beings	J_e*
Bhavya Jīva Rāśi		Set of accomplished living-beings	J_e+
Kevala Jñāna Rāśi	के	Set of (indivisible-corresponding-sections of) all knowledge	0^m
Avadhi Jñāna Rāśi	ओ	Set of (indivisible corresponding-sections of) clairvoyance knowledge	*A*

Term	*Ancient*	*Synonym*	*Working Symbol*
Karmic Sets[33]			
Samaya Prabaddha	स	Set of *Karmic* particles bound at an instant (used as a variable measure)	*B*
Utkṛṣṭa Samaya Prabaddha	स ब	supremum set of *Karmic* particles bound instantaneously	*Ba*
Varga	ब	Set of indivisible-corresponding-sections of energy-impartation associated with a *Karmic* particle	*V*
Vargaṇā		A set of *Vargas*. These form equivalence classes out of the ultimate particles of matter at their various levels of *Karmic* impartation.	*W*
Spardhaka	१	A set of various *Vargaṇās*	*Z*
Guṇahāni	गु	A set of *Spardhakas*. *Vargaṇās* and the *Spardhakas* form mathematical sequences forming semi-groups.	*G*
Nānā Guṇahāni	ना	A set of various *Guṇahānis*	*N*
Kiñcidūna dvyardha Guṇahāni	१२	Slightly less than a set of one and half *Guṇahānis*	$1\frac{1}{2}G^*$
Karmic Denominators[34]			
Apakarṣaṇa Bhāgahāra or छे *aaa*	ओ (उ)	Down-traction Denominator in a *Karmic matrix*	$\frac{\log_2 P}{aaa}$
Guṇa Saṃkramaṇa Bhāgahāra or छे *aaaa*	गु	Geometric-transition Denominator	$\frac{\log_2 P}{aaaa}$
Sarva Saṃkramaṇa Bhāgahāra	१	All-transition Denominator	1
Adhaḥpravṛtta Bhāgahāra	छे *aa*	Low-tended Denominator	$\frac{\log_2 P}{aa}$
Vidhyāta Saṃkramaṇa	२ *aa*	Statutory-transition Denominator	$\frac{F}{aa}$
Udvelana	२ *a*	Stimulation	$\frac{F}{a}$

Term	*Ancient*	*Synonym*	*Working Symbol*
Set Denotations			
Karma Paramāṇu Rāśi		Set of *Karmic* ultimate particles	k.u.p.
Avibhāgi-praticcheda-Rāśi		Set of indivisible-corresponding Sections (abbr).	i.c.s.

4. Cognate Terminology

The following synonyms will approximate to the cognate terms[35] as far as possible.

Synonym	*Term*
action	*karma*
advenience	*adhyavasāya*
affection (input function)	*kaṣāya*
annihilation	*kṣapaṇā, kṣaya*
annihilator	*kṣāyika*
axis-communication	*akṣa-saṃkramaṇa*
attachment (input function)	*moha*
becoming (phase)	*bhāva*
being (living)	*jīva*
block (a specific division)	*ghāta*
blocking	*ghātiyā*
bond (state)	*bandha*
change	*parivartana*
charge (resp. positive, negative)	*sparśa* (resp. *snigdha, rukṣa*)
configuration	*prakṛti*
control	*guṇa*
correct	*Samyak*
decay (output)	*galana*
denominator	*bhāgahāra*
determinant	*pāriṇāmika*
disintegration (output)	*nirjarā*
disjunction	*visaṃyojana*
disposition	*cāritra*
down-traction	*apakarṣaṇa*
event	*paryāya*
fall	*patana*
field (internal)	*upādāna*
(external)	*nimitta*
fluent	*dravya*
frustule	*phāli*

Synonym	*Term*
geometric-regression	*guṇahāni*
geometric-progression	*guṇaśreṇī*
geometric-transmutation	*guṇasaṃkramaṇa*
gulp	*āgāla*
impedance (input)	*saṃvara*
impulse-impartation energy	*anubhāga*
indivisible-corresponding-section	*avibhāga-praticcheda*
influx (input)	*āsrava*
injection	*nikṣepaṇa*
instant-effective-bond	*samaya-prabaddha*
intra	*māhī*
invariable	*acala*
length	*āyāma*
life-time	*sthiti*
maximum	*utkṛṣṭa*
minimum	*jaghanya*
mutual product set	*anyonyābhyasta rāśi*
non-premature-rise-cum-non-transmutation	*nidhatti*
devoid of premature-rise-transmutation -down-traction-uptraction	*nikācita*
nisus	*niṣeka*
norm	*artha*
operator (resp. low-tended, unprecedented, invariant)	*karaṇa* (resp. *adhaḥ-pravṛtta, apūrva, anivṛtti*)
rise (output)	*udaya*
overinstallation	*atisthāpana*
paratract	*anukṛṣṭi*
partition	*kāṇḍaka*
perturbation	*udvelana*
phase	*bhāva* (set of instantaneous events)
point	*pradeśa*
premature-rise	*udīraṇā*
projection	*prakṣepaṇa*
quarters	*kṣetra*
reachable	*bhavya*
realization	*labdhi*
reduction	*apasaraṇa*
removal	*apavartana*

Synonym	*Term*
rise	*udaya*
section	*khaṇḍa*
state-existence	*sattva*
station	*sthāna*
statutory	*vidhyāta*
structure	*racanā*
subsidence	*upaśama*
termination	*vyucchitti*
time-lag	*ābādhā-kāla*
tract	*kṛṣṭi*
transformation	*pariṇamana*
transmutation	*saṃkramaṇa*
ultimate-particle	*paramāṇu*
uptraction	*utkarṣaṇa*
vision	*darśana*
volition (input)	*yoga*
way-ward station	*mārgaṇā sthāna*

5. Basic Mathematicophysical Concepts and System-Theoretic Principles

The basic concepts and principles laid down for the system theory in Prakrit texts have already been detailed on set-theoretic approach[36] in the earlier papers. They include those on the Cartesian E^8 frame[37], relativity[38], causality, simultaneity, quantum theory, and topological spaces located through sequences[40]. The theory of ultimate particles[41] has also been touched in the context.

Although the *Karma* system theory is concerned with the bios and matter, the basis of cosmos is essential to relate here for an understanding of the post-universal measures : [42]

"The collection of soul, matter, aether, anti-aether, and space is related to be *samaya* by Jina. That very is the universe and beyond it is the endless non-universe." *//PK.* 3//

"Souls, matter, aether, anti-aether and space are corporeal, eternal, indifferent, and polypointed." *//PK.* 4//

"Whose existential own-phase is definite alongwith various controls and events, they are called existential-corporeal. They build the universe-triplet." *//PK.* 5//

"Those existential corporeal alongwith change-characteristic time become fluents and flowing in fluent-phases in time-triplet are called non-eternal." *// PK. 6 //*

"All the above (fluents), though mutually (are) entering each other, accomodating and mixing with each other, never give up their own-phase." *//PK 7//*

The following define the *Karmic* system : [43]

"Soul, non-soul, influx, bond, impedance, annihilation, and liberation are the tautos." *//UTS.* 1.4//

"Soul, non-soul, merit, demerit, input, impedance, annihilation and liberation are the substances (syllable norms)" *//PK.* 108//

"This universe is throughout extremely full of the matter corporeals which are fit (for becoming *Karma Vargaṇās*) or otherwise and are minute as well as corpulent." *//PS.* 76//

"On getting the soul's transformation (phases), material particles, fit for becoming *Karma*, pass into *Karmic* phase (automatically). They are not so transformed by the soul. *//PS.* 77//

"When the soul transforms through affinity and anti-affinity into merital and demerital phases, then (the very instant) enters the *Karmic* dust with phases or knowledge-obscuring etc." *//PS.* 95//

It may be marked that the *Karmic* system has a duality : the phases of a soul and those of a material particle play their own role automatically in the fields of each other : maintaining their mutual independence. In the following verses from *Dravya Saṃgraha*, this point has been made clear :[44]

"The transform (phase) of a soul due to which there is influx of *Karma* is known as phase-influx. The influx of *Karma* is the other (fluent influx) *//DSN.* 29//

"The conscious phase of the soul due to which there is binding of *Karma*, is the phase-bond. The mutual entrance of *Karmic* and soul's points is the other (fluent-bond)." *//DSN.* 32//

"The conscious transform (phase) of the soul due to which there is impedance in the input of *Karma*, is determined as the phase-impedance. The other (fluent-impedance) is that which impedes the input of fluent (particles)" *//DSN.* 34//

"The phase due to which material *Karma*, whose impulse has been imparted at (completion of its) life-times or at self-denial, disintegrates is the other type." *//DSN.* 36//

Thus the five types of the phases of a mundane soul are given in the following : [45]

"The phases of a soul owing to subsidence, annihilation, mixed, and the rise operations of *Karma*, as also its determinant phase, are its own tautos." //*UTS*. 2.1//

The control stations of such a dual biophysical system (automaton) are due to volition and attachment, and the way-ward stations are due to own *Karmas* : [46]

"The control stations are denoted as project and domain, and are due to volition and attachment. The way-ward stations are known as extensions and direction (range), and are due to own *Karmas*." //*GJK*. 3.//

The attached table gives the correspondence relations or controls as input with 148 *Karmic* subconfigurations as observables.[47] (Vide Appendix)

6. Role of Yoga and Kaṣāya

Yoga is action—coordinator through mind, larynx and body. *Kaṣāya* is action-tractor. *Moha* is of two types : vision-protractor and disposition-protractor (*Kaṣāya*).

The following verses define *Yoga* and *Kaṣāya* : [48]

"The causal energy responsible for influx of *Karma*, belonging to the soul yoked with mind, larynx and body, due to rise of the material disintegrated body *(nāma-Karma)*, is called *Yoga*." //*GJK*. 216//

"As (the *Kaṣāya* operator) tracts the *Karmic* field whose world-range is far off and which produces many types of crops of pleasures and pains of a soul, hence it is called *Kaṣāya*." //*GJK*. 282//

The following verses define their system-theoretic operations : [49]

"The action of the body, larynx and mind is *Yoga*." //*UTS*. 6.1//

"It is influx (input)." //*UTS*. 6.2//

"It is (either) with *Kaṣāya* which extends transmigration, or it is without *Kaṣāya*, called *Īryāpatha*." //*UTS*. 6.4.//

"Intense phase induced by the rise-output of the *Kaṣāya* causes the (influx-input of) disposition-attachment." //*UTS*. 6.14//

"The causes of (*Karma*) bond are mythic vision, vowlessness, negligence, *Kaṣāya* and *Yoga*" //*UTS*. 8.1//

"The soul, actuated by *Kaṣāya*, inputs (particles of) matter fit for becoming *Karma*. Shis is bond." //*UTS*. 8.2//

The denominated (*Karmic* matter of) endlessly endless space-points, (always) pervade in a subtle form the entire space-points of every soul which causes influx because of *Yoga*." //*UTS* 8.24//

Yoga is of two types : phase-*Yoga* and fluent-*Yoga*.

The least effective phase-*Yoga* is defined as follows : [50]
Let all points (L^3) of a soul be observed for a point having least effective phase-*Yoga*. At such a point, let the least effective phase-*Yoga* be extended by abstraction. Search the point where the phase-*Yoga* is next greater than the least effective phase-*Yoga*. The difference in phase-*Yoga* so obtained is called an i. c. s. of phase-*Yoga*. The least effective phase-*Yoga* is a set aL^3 i. c. s. of phase-*Yoga*. The i. c. s. of phase-*Yoga* may be called a unity-quantum of phase-*Yoga* action. The least effective threshold of phase-*Yoga* is called a *Varga* corresponding to the vibration point of the soul. If the threshold value of phase-*Yoga* is taken to be nh, the next effective phase-*Yoga* would have $nh+h$, where h may be taken as unity or an i. c. s. of phase-*Yoga*. The perturbation of the soul-point is fluent-*Yoga*, whereas the causal operative energy is the phase-*Yoga*. The successive measures of phase-*Yoga* are obtained adding unities of such i. c. s.'s to the least effective threshold of phase-*Yoga* or *Varga*.

The subsequent relevant measures of phase-*Yoga* are described in the following verses : [51]

"According to i. c. s. representation, how many *Yoga* i. c. s.'s belong to every one of the soul-points ?" //*SK*. 4.2.4—178//

"There are innumerable universes of *Yoga* i. c. s.'s belonging to every one of the soul-points." //*SK*. 4.2.4.—179//

"According to *Varganā* representation, a *Varganā* is of aL^3 of *Yoga* i. c. s.'s." //*SK*. 4.2.4—180//

"Thus there are L divided by a innumerable *Varganās*." //*SK* 4.2.4—181//

"According to *Spardhaka* representation L divided by a (innumerable) *Varganā* constitute a *spardhaka*." //*SK*. 4.2.4—182//

"Thus in a *Yoga*-station there are L divided by a (innumerable) *Spardhakas*." //*SK*. 4.2.4—183//

"The successive *Yoga*-stations upto the greatest are apiece in excess and apiece in excess." //*SK*. 4.2.4—191//

"The measure of the excess is F divided by a *Spardhakas*." //*SK*. 4.2.4—192//

"The twice increase-decrease station difference of *Yoga* is L divided by a and the twice increase-decrease station difference of *Yogas* is P divided by a." //*SK*. 4.2.4—195//

"According to increase representation, there are innumerate part increase-decrease, numerate part increase-decrease, numerate times increase-decrease and innumerate times increase-decrease." //*SK* 4.2.4—201//

"The point-bond stations are as many as are the *Yoga* stations. The point-bond stations are specifically more than those of the configuration." *SK*. 4.2.4—213//

Now, in the modus operandi of *Kaṣāya*, the application *Vargaṇās* are of two types : time-application *Vargaṇās* and phase-application *Vargaṇas*. (*KP*, *CS*, 69. 178). The minimum, maximum, etc. stations of time in relation to application of *Kaṣāyas* are time-application *Vargaṇās* (*KP*, *CS*, 69.179). The rise-output stations of *Kaṣāyas* are called phase-application *Vargaṇās*. (*KP*, *CS*, 69.180). The rise-output station of *Kaṣāya* is also called an impulse-impartation. (*KP*, *CS*, 69.200). The measure of the rise stations is aL^s. (*KP*, *CS*, 69.291).

The least effective rise station or impulse-impartation may be measured as follows : [52]

By abstraction, in a k. u. p., there may be located the least effective impulse. At such particles, let there be searched an impulse next greater than the least effective impulse. The difference in these impulses is called an i. c. s. of an impulse. The least effective impulse is the set of @J i. c. s.'s. (*MB*, 372).

The following verses expose other measures in relation to *Kaṣāya*[53]:

"In accordance with i. c. s. representation, how many i. c. s.'s are there in an impulse (*Anubhāga*) station ? There are endless i. c. s.' s which are @J in every one of the station." // *SK*. 4. 2. 7—199 //

"According to station representation, how many are the stations. There are aL^s stations." // *SK*. 4. 2. 7-200 //

"According to increase representation, there are infinite part increase-decrease, innumerate part increase-decrease, numerate part increase-decrease, numerate times increase-decrease, innumerate times increase-decrease and infinite times increase-decrease." // *SK* 4. 2. 7-246 //

According to *Dhavalā* commentary[54] however, for defining the *Varga*, all the k. u. p.'s corresponding to the least impulse station are collected and the touch control of such a k. u. p. with least impulse is divided through abstraction till an indivisible part is obtained. Thus in an impulse station are found @J i. c. s.'s.

From the above it appears that *Yoga* and *Kaṣāya* could be roughly denoted as kinetic and potential types of energy respectively. *Yoga* and *Kaṣāya*

form a complex, known as *Leśyā*. *Kaṣāyā* is correlated with *Anubhāga* which has to do with the touch control or charge. Thus the energy-levels of *Anubhāga* find relations with charge-levels. *Varga*, *Vargaṇa* etc. have already been detailed in earlier papers.[55] It is important to note that *Yoga* is instrumental for configuration and particle bonds, whereas *Kaṣāya* is instrumental for life-time and impulse-impartation bonds[56].

7, Structural Details of *Karma* System

The following data formalize the structural part of the dynamical *Karma* system into a composite mathematical concept[57]. The algebraico-topologic theory could be visualized in these details, alongwith the operational mechanism evolved by the school as described in the next section.

(1) *Time Set*

The indivisible instant defined in this school, forms a continuous sequence of instants, duly ordered, in the past, present and future time. This defines causality as well as simultaneity.[58]

If Z^* is regarded as the set of integers, the continuous time system is defined if the events are ordered, instant-wise. It could be called discrete time if the events are ordered, trail-wise. Thus the instantwise system may be a base for the reals on or $Z^*_{N_1}$; and the trail-wise system for the integers or $Z^*_{N_0}$. A set of of innumerable instants make a trail. The life-time involve periods like *antarmuhūrta*, *muhūrta*, days, months, years, *palya* and *sāgara*. It is as if a record-play is tracted with mild or intense *kasāya* for specific periods, reproducing impressions whenever called into play.

(2) *Input values, Input functions and their Relations*

Relative to generation, the influx-input relation between a soul and matter is ab-aeterno[59] and the correspondence is one-many, many-many and many-one as well as in case of *nigoda* bios. Owing to procreation through the rise-output phases of a mundane soul, kinetic effect alongwith potential effect (*pariṇāma*) may be called *karma*.[60] The matter-particles procreated to effect at the very instant due to the instrumental cause may also be called *karma*. The *karmic* matter then gets transformed into five types of bodies. The bios is also procreated to change due to the instrumental cause (field) of the phase-rise of *karmic* matter at the very instant. Thus both, the phase-rises out-puts of the bios and the *karmic* matter connected with it work as feedback inputs, generally. to prolong the working of a bios-*Karma* system.

The performance of the above dual system is governed (controlled) by variations in *Yoga* and *Moha* which are instantaneously called into play at

the rise-outputs of name and attachment *karmic* discharge[61]. The first four types of phases (bhāvas) of a bios are set free and upto the thirteenth control station *yoga* persists, whereas *moha* persists till the twelfth control station.

The influx-input values are related in the following verses[62]:

"Owing to *Yoga*, (the bios) causes influx-input of *B* lying between (two sets), J_e—multiplied by @ and J_{e*} divided by @. Due to *Yoga* extensions inputs may be different from *B*." // *GKK*. 4 //

"Endlessly @ k. u. p. form a *Vargaṇā* and @ *Vargaṇās* form an instant-effective-bond (*B*)." // *GJK*. 245 //

"The *B*'s of *Āudārika*, *Vaikriyaka*, *Āhāraka* bodies are each successively multiplies of *L* as divided by *a*, whereas the *B*'s of *taijasa* and *kārmāṇa* bodies are @ times. Yet these bodies are each successively finer than the preceding." // *GJK*. 245 //

"On every ultimate particle of *karma* and *nokarma* lie infinite times *visrasopacaya* u. p.'s related to a bios." // *GJK*. 249 //

Thus the influx-input space is *visrasopacaya* fluent[63]

$$B\ a^{\frac{3}{2}G*}\ J\ @.$$

The *kārmāṇa* fluent alongwith the *visrasopacaya* fluent forms the complete *visrasopacaya* space

$$B\ a\ 1\tfrac{1}{2}\ G^*J\ (@+1)$$

Note that

$$J_e - < B\ a < J_{e*}\ .$$

Now the influx-input values could be placed in a column matrix with cellular elements as nisusus with ordered life-time with provision of time-lag. The nisus having the maximum mass-points and ground energy-level of impulse is at the bottom[64]. (*GKK*. 160-162).

The value of *B* in terms of all the influx of particles lying in all the nisusus of an instant-effective-bond may be calculated as follows ; The nisusus, pertaining to several configurations, belong to various geometric-regressions of *B*. As is already known, geometric-regressions are formed from Z's, *W*'s and *V*'s as detailed by Jain[65].

Let the number of k. u. p. 's in the first nisus (or term) of the first geometric-regression be *x*, common-difference *d*, number of terms *n*, and the number of geometric regressions be *y*.

The relation between x, d, and n is $d = \frac{x}{2n}$.

For the next geometric-regression, the number of particles in the first nisus will be $\frac{1}{2}x$. the common difference $\frac{1}{2}d$. Thus the aggregate of particles in in various geometric-regressions. $G_1, G_2, \ldots, G_y$ will be as under :

$$G_1 = x + (x-d) + (x-2d) + \ldots + (x-(n-1)\,d)$$

$$G_2 = \tfrac{1}{2}x + \tfrac{1}{2}(x-d) + \tfrac{1}{2}(x-2d) + \ldots + \tfrac{1}{2}x - (n-1)\,d)$$

$$\ldots \quad \ldots \quad \ldots \quad \ldots$$

$$\ldots \quad \ldots \quad \ldots \quad \ldots$$

$$G_y = \frac{x}{2^{y-1}} + \left(\frac{x}{2^{y-1}} - \frac{d}{2^{y-1}}\right) + \ldots + \left(\frac{x}{2^{y-1}} - (n-1)\,\frac{d}{2^{y-1}}\right).$$

Thus the sum of all the geometric-regressions will be

$$B = G_1 + G_1 + \cdots + G_y$$

$$= \tfrac{1}{2}n\,(2x-(n-1)\,d)\left(1 + \tfrac{1}{2} + \tfrac{1}{4} + \ldots\ldots + \frac{1}{2^{y-1}}\right),$$

because $G_1 = 2^1$, $G_2 = 2^2$, $G_3 = 2^3$, $G_4 = \cdots$.

But as $d = \frac{x}{2n}$, we have

$$B = \tfrac{1}{4}\,x\,(3n+1)\left(1 + \tfrac{1}{2} + \tfrac{1}{4} + \ldots + \frac{1}{2^{y-1}}\right).$$

Thus B depends on x, n, y which may vary due to *yoga*.

As *yoga* is accompanied with *moha* upto the twelfth control station the bond-inputs become simultaneously effective. Thus a *vargaṇā* is associated with certain configurations, mass-number of *vargas*, life-time and an impulse energy-level. When a *vargaṇā* is set in order of its decay instant etc., it becomes a nisus, placed in the column matrix belonging to input or state or output, at the corresponding energy-level of impulse. The process of the state transition is far more complicated as appears from the manipulation through the simple matrix of the nisusus.

It will be seen in operational details in the next section, the controls are effected by gradual regulation of *yoga* and *moha* opperations alongwith the free phase-operations of the bios. The three types of phase-inputs : low-tended, unprecedented and invariant, are effective in annihilation of configurations etc. like those at the mythic vision, and so on.[66]

(3) Norms of Mathematical Objects Corresponding to Input

(A) Measure in terms of energy sections corresponding to yoga-station.[67]

(*i*) The least number of indivisible i. c. s.'s in a *varga* of *yoga*, forming a threshold set of energy-level is $L^s a$.

(*ii*) The set of *vargas* in *vargaṇā* of *yoga* is $L^s a$.

(*iii*) The set of *vargaṇās* in a *spardhaka* of *yoga* is L divided by a.

(*iv*) The set of *spardhakas* in a *guṇahāni* is L divided by aa.

(*v*) The set of *guṇahānis* in a *yoga* station is P divided by aa.

(*B*) *Measure in terms of fluent corresponding to a yoga station*

(*i*) The set of fluent-points corresponding to a *yoga* station is L^s.

(*ii*) The set of instants in life-time corresponding to a *yoga* station is L divided by a.

(*iii*) The geometric regressions are L divided by aa,

(*iv*) Number of various *guṇahānis* is P divided by aa.

(*v*) Set of two *guṇahāni* is $2(L$ divided by $aa)$.

(*vi*) Mutual product set corresponding to a *yoga* station is P divided by a.

(*C*) *Miscellaneous*

When the set of all the yoga stations is multiplied by the set of the aL^s, the product gives the set of all *karmic* configurations. When this product is multiplied by the set sP, the result is the set of classifications of life-time of all configurations. The latter set when multiplied by a gives the set of life-time bonding advenience stations. (*AS* - I, pp. 230, 231, *GJK*, p. 258)

(*D*) *Measure in relation to Mohic structures*[68]

(i) In case of affection (*Kaṣāya*) space, the fluent space, is the set aL^s of affection binding advenience stations. At these stations are caused the life-time and impulse bonds in the configurations and mass-points.

(ii) The life-time station is the set of classification of sP life-time ranging from the minimum life-time of a configuration to the maximum one.

(iii) The set of various *guṇahānis* is equal to $\log_s P$ divided by a.

(iv) The act of the mutual product is P divided by a.

(v) The norm of a *guṇahāni* is equal to the set of *guṇahānis* as divided by the set of life-time instants.

(vi) The set of the affection binding advenience stations causing least life-time bond is aL^s.

Note : (1) Here the initial sum (*ādi-dhana*) is equal to the number of terms multiplied by the initial term.

(2) The common difference is equal to the initial sum as divided by the norm of *guṇahāni* as increased by one. The common difference sum is equal to the number of terms minus one, as divided by two and multiplied by the common difference and number of terms.

(3) The total fluent of the first *guṇahāni* is equal to the initial sum plus the common difference sum. This fluent becomes double per succeeding *guṇahāni* and in the end double the amount of the set of various *guṇahānis* as decreased by one. The fluent of the last *guṇahāni* is equal to half the mutual product set multiplied by the initial.

(vii) Thus for a set of sP life-bound classifications of a configuration, one gets the aL^3 of life-time bond-advenience stations : or the fluent of all *guṇahānis*.

(viii) The set of impulse bonding-advenience stations is equal to aL^3 multiplied by the set of life-time bond-adveniences (aL^3).

(ix) The fluent is obtained as $aL^3\ aL^3\ a$.

(x) The number of the particles of *karmic* points is infinite times the set of the impulse bond-advenience stations : $@aL^3\ aL^3$

(xi) The number of i. c. s.'s are $@@\ aL^3\ aL^3$

(*GKK*, p. 374 et seq.)

(*E*) *Miscellaneous relevant measures*[69]

(i) There is a set of particles in point-bond in relation to a single bios given by the quotient set F^3 divided by P/a. This is the quarter occupied by a body. When this amount is subtracted from the volume of the universe, the amount of several quarters (*aneka-kṣetra*) is obtained :

$$L^3 - (F^3 \div P/a)$$

(ii) The total number of u. p.'s that could take part in *karmic* systems is known as the fluent set $J@$.

(iii) The fluent with regard to a single quarter is the quotient set

$$(J\ @\ F^3) \div (L^3\ P/a).$$

For many quarters it is

$$\frac{J@}{L^3}\left(L^3 - \frac{F^3}{P/a}\right).$$

(*iv*) The fluent fit to become *karma* in relation to single-quarter is the quotient set

$$(J\ @\ F^3) \div (L^3\ @\ P/a).$$

(*v*) The amount of fluent not fit for becoming *karma* in relation to single quarter is

$$(J\ @\ F^3\ (\ @-1)) \div \left(L^3\ \frac{P}{a}@\right)$$

(*vi*) The fluent which is with beginning in relation to *karma* systematic functioning is the product set

$$B_{\max}\, T^{-}\, J\,(1)$$

(*vii*) In relation to single quater the above is

$$(B_{\max}\, T^{-}\, J\, F^{3}) \div (L^{3}\, P/a)$$

(*viii*) For many quarters it is

$$\left(\frac{B_{\max}\, T^{-}\, J\, L^{3}}{L^{\omega}} - \frac{F^{3}}{P/a}\right)$$

(*ix*) The fluent set having no beginning in relation to *karma* is

$$J\,@\, -\, (B_{\max}\, T^{-}\, J\,(1))$$

(AS-I, p. 213 et seq.)

(*x*) The maximum and minimum periods of life-times are

$$C\ 30\ (10)^{14} \text{ and } s\ R \text{ respectively.}$$

(*xi*) The time-lag for the longevity *karma* is not statutory, whereas for the remaining seven *karmas*, its proportion with life-time is[70]

$$100 \text{ years} : (10)^{14}\ C$$

(For details, *GKK*, vv. 156-160).

(4) *State and Its Transition*

There is a set $B\ a\ 1\frac{1}{2}\ G^{*}$, called state set, included in the *karma* system. Equation of motion of the system is decided from the rate of change of the collected input columns and disintegrating output rows of the fluent corresponding to *karma* state matrix. In *GJK* and *GKK*, the state matrix has been given in the form of a triangular matrix structure where input is from the right towards the left and output is from the lowest row.[71] Jain has already given a brief account of this phenomenon.[72]

The numerical symbolism in *AS*-I, pp. 67-111, for the triangular matrix and its sum has been adopted for a constant, linear, dynamical system.[73] However, every symbol therein is a nisus which is actually to be associated with four varying measures of the quantities expressible in the units of *karmic* configurations, mass-points, life-time and impulse-energy-level. Then provision is to be made for non-linear and time-dependent as well as variable system due to variable *yogic* and *mohic* inputs as well as impedances providing control etc. for realizations.

The transmutations between subconfigurations are divisors operators. In *KP*, *CS* the details run from p. 45 to p. 464. In *AS*-I, pp. 266-268, the followiug comparability appears in successive increasing magnitude : [74]

All transmutation 1

Geometric transmutation	$(\log_2 P) / aaaa$
Uptraction and downtraction	$(\log_2 P) / aaa$
Low-tended	$(\log_2 P) / aa$
Yoga-multiple	$(\log_2 P) / a$
Life-time's various *guṇahānis*	$\log_2 P - \log_2 \log_2 P$
Logarithm of *palya* to base two	$\log_2 P$
Square root of *palya*	$(P)^{1/2}$
Life-times *guṇahāni*	$(Ps)/(\log_2 P - \log_2 \log_2 P)$
Mutual-product	$(P) / (\log_2 \log_2 P)$
Palya	P
Karma life-time	Ps
Statutory transmutation	$(F) / aa$
Stimulation-transmutation	F / a
Impulse energy set of various *guṇahānis*	@
Guṇahānis	@@
One and half *guṇahānis*	@@ $1\frac{1}{2}$
Two *guṇahānis*	@@ 2
Mutual-product	@@ 2 @.

Further operational details to be described in the next section cover pp. 465-905 of the *KP, CS*. The description of state with respect to configurations only cover vv. 333-394 of *GKK*. State stations regarding *moha*, bios aggregates and way-ward stations are pointed in *GKK*, vv. 508-518, 704-739.

The algebraic sum of all elements of a state matrix at any instant will form a polynomial, in general. As Kalman puts in, the linear system may be described through a module, the bonds of particles as well as their energy levels of impulse, alongwith changes in configurations and mass numbers being manoeuvred through shift operators when set in a proper computer constructed specifically for the calculation of a *karma* system.

Here it has been possible to calculculate the ratio between the state values set and the input values set as follows :

The sum of the elements of the state triangular numerical matrix has been calculated through three methods in *GKK-AS*-I, pp. 87-111. The modern exposition may be as follows :

Let us sum up the diagonals of each column of each *guṇahāni* in the state-triangular matrix. Let D_1 denote the total number of nisus-particles in all the diagonals corresponding to the n rows of *Guṇahāni* G_1, and so on.

Then the values of the D_y's $(y=1, 2, \ldots)$, i.e. the number of particles they contain is given as under with x as first term, y as the number of

guṇahānis, d as the common-difference, and n as the number of terms in a *Guṇahāni*, as before.

$$D_1 = x + 2(x-d) + 3(x-2d) + \ldots\ldots + n(x-(n-1)d)$$

$$D_2 = (n+1)\tfrac{1}{3}\, x + (n+2)\tfrac{1}{2}\,(x-d)\ldots\ldots$$

$$\ldots\ \ldots\ \ldots\ \ldots\ \ldots$$

$$\ldots\ \ldots\ \ldots\ \ldots\ \ldots$$

$$D_y = ((y-1)\,n+1)\frac{x}{2^{y-1}} + ((y-1)\,n+2)\left(\frac{x}{2^{y-1}} - \frac{d}{2^{y-1}}\right) + \ldots$$

Let the sum of all the diagonals above be S, so that

$$S = D_1 + D_2 + D_3 + \cdots + D_y$$

$$= \left(1 + \tfrac{1}{2} + \ldots\ldots + \frac{1}{2^{y-1}}\right)\frac{x}{12}(13n^2 + 9n + 2),$$

$$\left(\text{on putting } d = \frac{x}{2n} \text{ and simplification.}\right)$$

The ratio of the state-matrix sum S and the input-matrix sum B is given as under :

$$\frac{S}{B} = \frac{13n^2+9n+2}{9n+9} = \frac{13}{9}\,n - \frac{4n-2}{4n+9}.$$

$$\text{or } S = B\left(\frac{13}{9}\,n - \frac{4n-2}{4n+9}\right).$$

Compare the above result with *Ba* $1\frac{1}{2}$ *G**.

5 *Output values, Output functions, and Other relations*

Every instant there is rise and disintegration of nisusus, as already shown in the figure of the state triangular matrix. For a constant linear, and *karmic* system, the output values[77] are B, otherwise they may be different from *B*.

"Every instant, an instant-effective-bond disintegrates, but due to extraordinary activity, many instant-effective-bonds *B*'s may disintegrate (from the state). However there are always existent slightly less than the product of one and a half *guṇahānis* with an instant-effective-bond (*B*. $1\frac{1}{2}$ *G**)". *//GKK.* 5//

The maximum amount of fluent fit for annihilation output is

$$= \frac{B\,a\ 1\frac{1}{2}\ G^*\ (J\ @+1)\ (L^3-1)\ a\ 64}{\frac{\log_2 P}{aaa}\ \frac{P}{a}\ L^3\ a\ 85}. \qquad (AS\text{-I, p. } 195)$$

The description of the rise and rise-termination of *karma* configuration[8] alone is given in *GKK*, vv. 261-332.

Before annihilation operators (like the low-tended etc.), an impedance may be operated upon as an input, to prevent influx. Thus controls adopted are workable either as impedance or annihilator so as to disintegrate the *karmic* matter to a maximum. This optimizes the realizations of controls of a bios. The target is the emergence output of $Ba\ 1\frac{1}{2}\ G*$.

The rise of *karma* work as a feed-back, picked up by a bios for further *yoga* and *moha* application. However, this may be rejected simultaneously for optimizing controls. *KP*, *CS* verses from p. 614 to 905 are devoted for realization output, and *LS* briefs the phenomena. The rise and premature rise of *karmas* have been detailed in *KP*, *CS*, pp. 465-531

For various types of output, the phases of a bios in various controls are decisive.

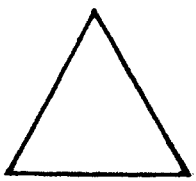
TABLE FOR MEASURES OF KARMIC SYSTEM EVENTS[78]

Name	*Influx*	*Impedance*	*Disintegration*	*Bond*	*Emergence*
FLUENT MEASURE	Ba	Ba	$\frac{Ba\ 1\frac{1}{2}\ G*\ 64}{A - \frac{P}{a}85}$	Ba	$Ba\ 1\frac{1}{2}\ G*$
QUARTER MEASURE	$L^1@$	$L^1@$	$L^1@$	$L^1@$	$L^1@+$
TIME MEASURE	$20C10^{14}@$	$20C10^{14}@$	$20C10^{14}@$	$20C10^{14}@$	$20C10^{14}@$
PHASE MEASURE	$\frac{0^m}{@@@}$	$\frac{0^m}{@@@}$	$\frac{0^m}{@@@}$	$\frac{0^m}{@@@}$	$\frac{0^m}{@@@}$

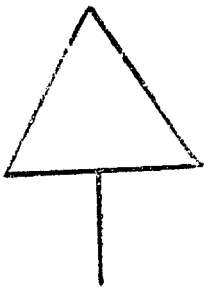
8. ELEMENTS OF OPERATIONAL ALGORITHM OF *KARMA* SYSTEM

The algorithm through the operations carried out in the Prakrit texts on *karma* theory is manifest from several diagramatic representations adopted in the commentary of the *LS* (*AS*-II). In *AS* I, however, elementary symbolism appears in the beginning as well as in the topics on *karmaic* bonds. The following simple symbols appear for *karma* life time structures[79]:

Time-lag

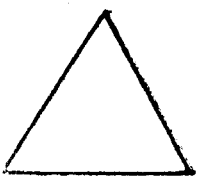


Nisusus-set (having many particles at the ground and less at the top in the *karma* matrix.)



Time-lag and a nisusus-set

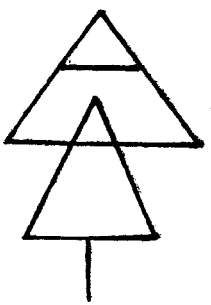
Invariant trail of instants or fluent (particles)



Rise-trail (*Udaya Āvali*)

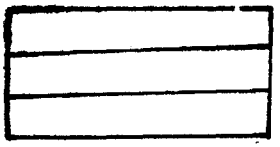
Upper Life-time

Remaining trail

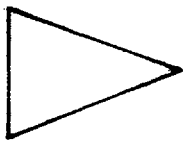


Mixed representation

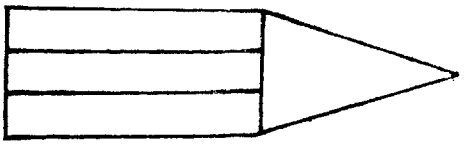
The following symbols appear for *karma* impulse-impartation energy :



Vargaṇā

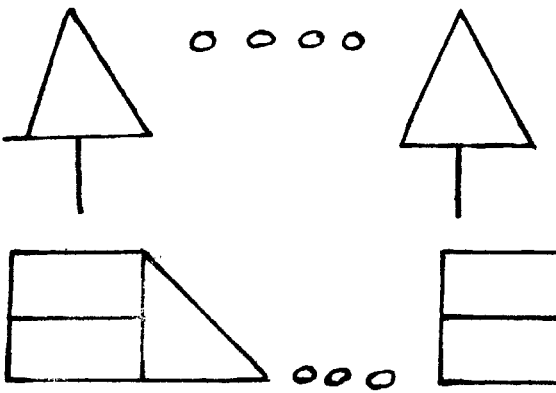


Varga



Mixed

The following figure is illustrative (*AS*-I, p. 197)



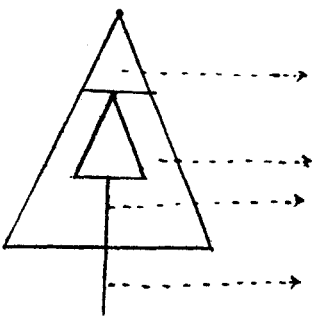
Life-time

Impulse

Point (Particle)

स ३२ ००० स १

The following diagram gives the usage, (*AS*-I, p. 210)



over-installation trail

upper-life-time

rise-trail

invariant-trail

There are a few more specific symbols for impulsive energies, denoted either through initial alphabet or through the numerical symbols.[80] (*AS* I, p. 211, et seq.)

It is due to the undying credit of Todarmala of Jaipur (*c.* 1720-1767) that his chapters on Symbols–norm (*Artha-samdṛṣṭi*) give us sufficient information regarding system-theoretic algorithm used in India as an unobservable drift of the under currents surviving through many centuries of isolation and privation. The following description is based on his introduction[81] to *LS*, as this is not available elsewhere in such a compact and definitional form. The description is about the operational results of the correct vision control and correct disposition control. The former is in relation to subsidence, annihilation-cum-subsidence and annihilation of *karmas*. The latter is in two phases : (i) Partial : that which is in relation to annihilation-cum-subsidence, subsidence, subsidence and annihilation of *karmas*. (ii) Complete : that which is also in relation to the above. The operational phases of bios lead to its realization of Omniscience, etc.

(I) *Definitions.*

In the description of *karmic* configurations, the corresponding use of k. u. p. 's, now abbreviated as *U*, is called fluent. For example, the *U* in the bond-set is called bond-fluent set. The set of *U* in form of state-existence is called state-existence-fluent set. The set of *U* in the nisusus of life-time partition is called partition-fluent set. The set of *U* in the first frustule is called first-frustule-fluent set and so on.

Leaving apart the nisusus in the lower portion or upper portion of the *karmic* matrix, when the nisusus of the intervening space are to be wiped out, the process is called inter-operation, and the set *U* so involved, is called inter-operation-fluent set. When *U* is made unfit for rise, the *U* is called subsidence-fluent set. When new *U* set is mixed into the nisusus which are in an arbitrary phase, the *U* is called injectable-fluent set. The union set of all *U* in the state-fluent set and injectable-fluent set is called the observable-fluent set.

Partition is called a part (*parva*). Just as a sugarcane is parted with, similarly the limiting-form of a station is called a *parva*. Just as the station in limiting-form of reduction in life-time is called life-time-partition, so also the station in limiting-form of reduction in impulse is called impulse partition. In case of life-time of pro-bonding configurations, four stations call upon four parts. There are three stations where down-tracted set of fluent is to be united.

The norm length is linear. Similarly the instants of time are not simultaneously overlapping, hence in case of linearity of time measure, 'norm' is used.

When there is continued upper-structure, the measure is also called 'norm'. The measure of life-time is called life-time-norm. The measure of nisusus of a life-time-partition is called life-time-partition-norm. The measure of nisusus wiped out during the inter-operation is called inter-norm. Similar is geometric-series-norm.

When the fluent is given to the nisusus in row of multiples, that is called geometric-series. When the U of an arbitrary subconfiguration transmutes into other form of it, into multiples every instant, then it is geometric-transmutation. When there is reduction in multiples, it is geometric-regression. The set of nisusus lying above the geometric-series-norm is called upper-life-time. In the description of premature-rise alone, the set of nisusus above the rise-trails is called upper-life-time. The name of lower-nisusus set is 'first-life-time :' The name of the set of nisusus of all life-time lying above is called second-life-time. The denomination, 'cow-tail' stands for sequential reduction through common-difference, one by one.

(II) *Ten operational phases of bond of karma* :

(a) *Bonding phase* : The befalling of a bios into a relation with new matter in form of *karma* is said to be in the bonding phase. This is of four types : (1) configuration, (2) mass-number (particles or points), (3) life-time, (4) impulse-impartation. The transformation of the *vargaṇā* space of *karmic* matter (fit for being transformed into *karma*) into eight fundamental types of configurations is called configuration-bond. The number of transformed particles into the above eight types (or 148 subtypes or aL^8 sub-subtypes) of configurations is called point-bond, because a particle means a point here. The *karmic vargaṇā* space is a U-set or B or aB or else its quotient, and is so called for every instant of bonding due to excess or deficit of *yoga*. The automatic distribution of aB into several configurations is detailed in *GKK*.

The period during which the particles remain in configuration-bond is called life-time bond. This is effected for B's every instant. The period from this instant upto the instant of rise of *karma* is called the time-lag. As there is no rise-output during the time-lag, there is no (matrix) structure of the nisusus. After the time-lag is over, the rise-output of the nisusus starts one by one, instant by instant, from the initial instant to last of the life-time. Thus the life-time of the first nisusus at the bottom of the first column is an instant, more than the time-lag. The life-time of the second (upper) nisusus is two instants more than the time-lag period. In this way the life-time of the last nisusus is the complete period of the life-time bond. This is the rule for all types of configurations except that for the longevity

for which the rule is given in *GKK*, v. 158. The impulse-bond expresses the intensity of impulse impartation. The forms of *V*, *W*, *Z* and *G* have already been elaborated in earlier papers. The rise-output of nisusus is ordered according to their life-time in the matrix-cells, but the rise-output of Z's is not necessarily ordered.

(b) *State transitional phase* : The collection of *karmic* influx and inputs, at an arbitrary instant, bound at various past instants, emptied through outputs by a bios is called its state-existence. The state is again of four types denoting the existence of the collected configurations, points, life-times, and impulses. The measure of point-state at any instant is a variable set $Ba\frac{1}{4}G^*$, mapped onto a triangular matrix with input output pairings. At different control stations the number of configurations of state differ as already charted. The life-time of the last (top) nisus will be the life-time of the state at an instant, for a particular configuration, from among the maximum of *aB*. For all configurations, the life-time of the maximal *B* of the configuration having maximum nisusus is decisive.

The combination of nisusus of several *B*'s are liable to rise at an instant corresponding to life time, or those bound at several instants are to be considered in relation to their corresponding *U*'s with respect to *V*'s, *W*'s *Z*'s as energy-levels of impulse state.

(c) *Rise phase* ; Tendency of the *karmas* at the proper time of their impartation of impulse and subsquent disintegration is the phase. As before, this is also of four types, which have been defined suitably.

The first nisus of *B* whose none nisus has decayed begins rise-output. The second nisus of *B* whose first nisus has decayed, discharges after rise. In this sequence, the last but one nisus of such a '*B*' begins rise-output, whose only two nisusus have remained to disintegrate.

If the *U*'s of the nisusus here fit for rise at the upper or lower other instants (in the triangular matrix), have been injected into the nisusus fit for rise at the very instant, then those *U*'s also rise along with them at the very instant. Regarding the rise-output of impulse, account should be taken of the *U*'s due to uptraction or downtraction.

(d) *Premature-rise phase* : The *karmas* which are still not to begin rise-output, are said to be in the phase of premature-rise. In this phase the set of nisusus, fit to begin rise-output from the present instant till the duration of a trail is called a rise-trail. The set or nisusus staying in the upper part of the matrix is called as external to the rise-trail. The *U*'s of the extremely situated set of nisusus are required to be mixed into the

set of nisusus of the rise-trail. Thus the instant when premature nisusus which were to begin output of rise later, are called upon to begin output simultaneously with those in the rise-trail, is the instant of premature-rise output for those U's.

(e) *Uptraction phase* : The increase in life-time and impulse is uptraction. The nisusus lying in the lower part of the matrix and about to begin output within a short span of time are uptracted towards the upper part of the *karmic* matrix and get injected into the nisusus having greater life-time, and thus attaining greater life-time. This is uptraction of life-time. Similar is the concept of uptraction of impulse.

(f) *Downtraction phase* : The decrease in life-time and impulse is downtraction. The concept is similar to the above.

Note : In the above two phases, the set of all the U's involved are to be divided by the uptraction or downtraction denominator, and the U's of the quotient alone is taken and properly injected into the upper or lower part of the matrix. The divisor of the uptraction and downtraction is a times that of geometric transmutation and is $1/a$ th part of that or the low-tended transmutation. It is $(\log_2 p)/a$.

(g) *Transmutation phase :* The transmutation of a subconfiguration of U's into another form of subconfiguration is transmutation and it happens to be in the same configuration. Its five types have already been described in structures. (*GKK* ch. V) The set of U's under the perturbantion phase of subconfiguration, when divided by the perturbation divisor, a quotient set is obtained, which gets transmuted into another subconfiguration. This is perturbation transmutation. Similar are the remaining.

(h) *Subsidence phase :* The set of U's of the nisusus, external to the rise-output trail corresponding to a particular configuration, is said to be in the subsidence phase as long as it can not be brought into the rise trail. This refers to the subsidence of all configurations upto the eighth control station where there are three revolutionary operations, upto which *nidhatti* and *nikācita* operational phases operate. The subsidence phase in relation to attachment is traced upto the eleventh control station.

(i) *Nidhatti phase* : As long as the set of U's of a particular configuration can niether be brought into transmutation nor into the rise trail, the phase is *nidhatti.*

(j) *Nikācita phase* : As long as the set of U's of a particular configuration can neither be brought into transmutation, nor into the rise-trail, as also could neither be brought into uptraction and downtraction, it is said to be in the *nikācita* phase.

(III) The order in termination of bonds :

Due to attainment of correct-vision control and disposition control, the most ungracious configurations are impeded from bond with bios. Then ungracious configurations leading to knowledge-obscuring etc. are impeded, and then the gracious are impeded. The reducing of configuration bond in a sequence is called ordered configuration-bond reduction. The point-bond depends upon variation in *yoga*, hence on diminution of *yoga*, point-bond is reduced. When there is an end of *yoga*, there is non-existence of point-bond.

The life-time bond depends on variation of attachment. It reduces on reduction of life-time bond. Thus the life-time bond goes on decreasing and the time for its termination arrives where there is the least life-time bond. This is the sequence in case of all configurations except that of longevity. During the period of life-time bond ordered reduction, there is equal life-time bond every instant, till the last instant of life-time bond ordered reduction. The latter is not possible in longevity configuration, hence the life-time bond of all longevity configurations, but for that of hellish beings is greater due to purity. The life-time bond of all other gracious and ungracious configurations is greater due to impurity and is lesser due to purity.

The impulse bond of the ungracious configurations is mild due to purity and intense due to impurity. The impulse bond of gracious configurations is mild due to impurity and intense due to purity. Thus the acquirement of correct vision and disposition controls lead to higher level of impulse bond of gracious configurations and that of the lower level of the ungracious. When *moha* operation comes to an end, there comes an end to the impulse bond. The blocking configurations may be treated as ungracious as they delude the bios, the gracious may not.

(IV) The sequence of annihilation of state-existence :

Owing to attainment of correct vision and disposition controls, the most ungracious, then the ungracious and then the gracious configurations get annihilated in state-existence. This annihilation is of two types : (1) own-aspect rise-annihilation and (2) other-aspect rise annihilation. If a configuration comes to an end on the rise of the last nisus of its life-time state, while maintaining its own form intact, the annihilation is of first type, otherwise it is of second type. There is bond of B and disintegration of a multiple of B. When bond stops, annihilation continues, no-point-state exists. The life-time state reduces one by one, every instant, as per rules of life-time partition and downtraction.

(V) Rule of life-time cut for life-time state-existence :

The life-time state is usually of great amount (minimum for certain configurations being an *antarmūhūrta*, the maximum for the *moha* being $70(10)^{14}$ C)

Thus a large number of nisusus are fit for rise-output every instant. Among them many of the upper nisusus are annihilated to reduce the life-time state. After annihilation of all the U's of those destructible nisusus, whatever life-time is left, is to be dealt with as follows :

The upper nisusus of such remaining life-time lying upto the rise-trail are left, and in all the remaining nisusus all the mentioned U's to be annihilated are injected. Out of all such U's some are to be mixed with the first instant, some with the second instant. This is to be carried upto sR. Thus the life-time state reduces by the amount of instants from which destructible nisusus have been brought to be mixed in the lower nisusus.

The transformation of the upper matrices in sequence, in form of lower matrices for reduction of life-time, is called life-time section. The life-time section during this process, through annihilation of nisusus is called life-time section normlength. All the U's of the nisusus fit for annihilation corresponding to life-time-section norm is called fluent-section. This amount is to be mixed into the remaining life-time nisusus. Corresponding to a trail-nisusus it is not to be mixed and this trail is called over-installation trail.

Mixing of the remaining life-time in the remaining nisusus of fluent-section is called partition-operation or partition-block. The duration within which the uptraction is completed is called partition-operation duration. The number of U's of the fluent-section mixed into the remaining nisusus at the first instant of the duration of partition-operation is called the first frustule. The set mixed at the last instant of this duration is the ultimate frustule. After the end of first partitioning, second partitioning starts. After lapse of seven partitions, there is no partitioning. and the little life-time left reduces instant by instant, and one by one on annihilation.

(*VI*) *The law for the down-tract :*

All the U's of all the nisusus of an arbitrary configuration when divided by the divisor set of the downtraction, the quotient set of U's so obtained is the down-tracted fluent set. From this set some U's are injected into the rise-trail, some are mixed into the geometric-series norm length, the remalning U's are then injected into the upper life-time. There, the nisusus from the present first instant upon the period of a trail are called a rise-trail. In these nisusus the fluent fit to be mixed is mixed in order, into every nisus decreasing every time by a common difference. The nisus set belonging to the next sR or M_i, lying above the nisusus of the rise-trail is called geometric-series-norm. In these nisusus, the fluent fit for being given to the geometric-series-norm, is mixed in the order of a times to every nisus after nisus.

Then above them, all the remaining nisusus corresponding to remaining life-time form a set called the upper-life-time. Among them, in the nisusus of the last trail, no fluent is mixed, and the trail is called the over-installation trail. Excluding this trail, the fluent to be mixed into the other nisusus is to be mixed after bringing them into the structure of various geometric regressions, and in decreasing order to every nisus, per common difference.

The measure of the nisusus of the geometric series, called the geometric-series norm, is decomposed remainder somewhere and constant (stable) elsewhere, according as it reduces one by one in nisusus every instant, or remains constant when the upper life-time nisusus go on mixing into it every instant.

(*VII*) *The law for reduction of impulse* :

Among the *U*'s of a configuration state, there is structure of *Z*'s, with excess and deficiency of impulse. The Z's lying in the lower part of the matrix have less impulse. The impulse of ungracious configurations is reduced due to correct vision and disposition. The rule for partitioning is the same here as that in the case of reduction of life-time.

The reduction of impulse by taking out many *Z*'s from the upper part, and mixing their *U*'s into the lower nisusus having less impulse is called impulse-partitioning. The partitioning operation is completed in M_{ϵ}. During this period, after annihilation of the *U*'s of the nisusus fit for annihilation, some nisusus are left into all of which (excepting those into the over-installation trail), some of the upper nisusus are to be mixed.

Taking all the *U*'s of *Z*'s fit for annihilation, the amount of *U*'s mixed into the remaining *Z*'s at the first instant of the impulse-partition is called the first frustule. This is how there is impulse-partition every instant reducing the impulse.

When there is greater purity, every instant there is reduction of impulse in infinite multiple order. The impulse which existed at the previous instant is divided by infinite, and the remainder (after the quotient set is subtracted from the original impulse) is annhilated. This is pro-instantaneous removal.

First the impulse of the ungracious configurations get annihilated Then that of gracious get annihilated, according to the rule of partitioning. At the time of transcombustion (*saṃjvalana*) *kaṣāyas,* the reduction in impulse is in accordance with the structure of the unprecedented *Z's* and with that of the gross traction. Lesser impulse is at the lower part and the greater one is at the upper part. Relative to them the tractions of the *Z*'s are mentioned as those in the lower and upper parts.

9. Concluding Remarks

The above details do not form a complete account of the system-theoretic approach adopted in the Jaina School, but rather a presage of what could be possibly attempted by the mathematical antiquarian who has still to delve deep into the technological secrets of its system theory.

The algorithm of this system theory requires an illustrated and more detailed exposition which is proposed to be attempted after this elementary article.

There are additional finer concepts and principles which have not found place in this paper. Those mathematical objects require modern algebraic and functional analytic probe into the historic and system-theoretic pursuits and access.

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APPENDIX

Correspondence of controls as input with 148 *karmic* subconfigurations as observables

	Control Station	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
1.	*Mithyātva*	117	16	117	5	117	5	148	0	3	5	5
2.	*Sāsādana*	101	25	111	9	111	9	145	0	19	11	11
3.	*Miśra*	74	0	100	1	100	1	147	0	46	22	22
4.	*Avirata Sam.*	77	10	104	17	104	17	148	1	43	18	18
5.	*Deśavirata*	67	4	87	8	87	8	147	1	53	35	35
6.	*Pramattavirata*	63	6	81	5	81	8	146	0	57	41	41
7.	*Apramattavir.*	59	1	76	4	73	4	146	4	61	46	49
8.	*Apūrvakaraṇa*	58	36	72	6	69	6	142	0	62	50	53
9.	*Anivṛttikara*	22	5	66	6	63	6	142	0	98	56	59
10.	*Sūksma Sāmp.*	17	16	60	1	57	1	142	0	103	62	65
11.	*Upaśānta Moha*	1	0	59	2	56	2	142	0	119	63	66
12.	*Kṣiṇa Moha*	1	0	57	16	54	16	101	16	119	65	68
13.	*Sayoga Kevalī*	1	1	42	30	39	39	85	0	119	80	83
14.	*Ayoga Kevalī*	0	0	12	12	0	25	85	85	120	110	

Codes :

(A) Number of binding configurations
(B) Number of bond-terminating configurations
(C) Number of rise-outputting configurations
(D) Number of rise-output-terminating configurations
(E) Number of premature rise-outputting configurations
(F) Number of premature rise-output-terminating configurations
(G) Number of state-existence configurations
(H) Number of state-existence terminating configurations
(I) Number of non-binding configurations
(J) Number of non-rise-outputting configurations
(K) Number of non-premature-rise-outputting configurations

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10. Cf. 5(b), op. cit.
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12. *SST*, cf. 9(a), op. cit.
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16. *JK*, ibid.
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33. Vid. 3(c) and (d) for definitional details.
34. Vid. 17, AS-I, p. 268. Cf. also 17, GKK, vv. 409-435 for details.
35. Most of the cognate terms are defined in 17(LS), op. cit.
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43. Cf. *UTC*, v. 1. 4 ; *PK* vv. 108 ; and *PS*, 76, 77, 95, op, cit,
44. Cf. *DSN*, vv. 29, 32, 34, 36, op, cit.
45. Cf. *UTS*, v. 2. 1, op. cit.
46. Cf. *GJK*, v. 3, op. cit.
47. Some of these have been briefed in *GKK*, vv. 87-357.
48. Cf. *GJK*, vv. 216, 282.
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50. Cf. *GKK*, pp. 310. et seq. also *MB*, vol. iv, (1957), p. 5, et seq.
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52. Cf. *GJK*, p. 374 et seq., and p. 257.
53. Cf. 6(b), p. 630, v. 199.
54. Cf. *SK*, 4. 2. 7-199-200-246.
55. Cf. Jain, 3(c), (d).
56. Cf. *GKK*, v. 257.
57. Cf. 1(a) and (b).
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60. Cf. *MB*, vol. 1(1947), pp. 45-47. Cf. also, *GKK*. v. 6.
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73. Cf. *AS*-I, pp. 87-111.
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