New Analytics of International Relations: System Forecast of Cold War's Outcomes

Victor A. Svetlov, Nikolay M. Sidorov[1]

[1] *Emperor Alexander I St. Petersburg State Transport University, 190031, 9 Moskovsky Ave., St. Petersburg, Russian Federation*

E-mail: Victsvetlov@yandex.ru

Abstract. Systemic forecasts of international relations evolution for quite a long time were quite a rare phenomenon. The main reason for this is the lack of independent of authors' ideological and political predilections reliable analysts, and this fact determines relevance of the current study. The main goal of the article is to develop new analytics that allows prediction of long-term trends in the evolution of international relations world system. Therefore, the algebra of relations and the corresponding section of predicate logic are used. The authors proved sixteen basic theorems on the properties of the world system. As the initial opposition, a pair of relations "dependence-independence" was chosen. The empirical conditions of the current state of affairs make it possible from the outset to exclude from the analysis the state of independence of states as a long-term factor of international politics. It was established that the world system of international relations can be strictly in one of three states – conflict, synergistic or antagonistic. The authors also carried out the forecast of the world states system dynamics after the end of the Cold War. In regards with impossibility of achieving by the international relations world system in the next thirty years any of two possible attractors – states of synergism and antagonism, predicts – its stable oscillation between these points of stability until at least the middle of the nineteenth century is forecasted. In practice, this means, depending on the direction of the trend, the emergence of a variety of waves of instability, primarily in the field of international security

Keywords: relational algebra, conflict, synergism, antagonism, one-pole state, double-pole state.

1. INTRODUCTION

Problem Statement. In the late 20th century the Warsaw Treaty organization dissolved and then the Soviet Union collapsed. The Cold War ended, and the world system's bipolar division into two antagonistic military and political blocs, established after the World War II, disappeared. The end of the age of the bipolar division of the world system makes the search for common regularities of international relations' structural changes relevant more than ever. Without theoretical solution of this problem, including its mathematical simulation, it's impossible to comprehend, for example, what trend currently dominates and what configuration of relations between states is most probable in the nearest future.

International relations play an important role in the implementation of the foreign policy of states, since they contribute to solving many economic, environmental issues, as well as issues related to the settlement and prevention of conflicts. Regional issues which may be related to a military conflict in a particular territory and to affect the interests of many states are also resolved at the international level. International relations are also viewed as human activity where individuals from more than a single state interact individually or in groups. International relations can be also presented as interaction between two or more states, and foreign policy as an external action of a nation that proves the relevance of the current topic [1].

There is very little agreement among international relations specialists about estimation of the most probable structure of international relations after the Cold War's end. Huntington S.

distinguished the following possible configurations based on the analysis of most authoritative research paradigms [2].

• There will be one relatively harmonious world. – Fukuyama's forecast [3].

• Despite inevitable economic interaction, the cultural opposition of West and East will never disappear. – Northrop's forecast [4].

• The world system will split into many autonomous nation states, each of them will strive for survival, entering alliances with other states or augmenting its potential independently. – Waltz's forecast [5].

• The world system will sink into an utter chaos, national states will dissolve, tribal and ethnic conflicts will escalate, terrorism will become a common phenomenon, international criminal groups will appear. – Brzezinski's forecast [4].

• A polycivilizational world divided into two global groups will appear – West civilization and a small array of non-western civilizations not related to each other, in total about 7-8. National states will remain leading players on the world stage, but conflicts between them will be caused by their belonging to two specified groups. – Huntington's forecast [2].

Each of the forecasts distinguished by Huntington, including his own one, predicts a certain result of rebuilding the system of states' international relations started after the Cold War's end. There is no doubt any one of them has its more or less ample grounds. However, it's crucial that none of them is based on the system nature of changing international relations. This circumstance explains analysts' dispersed opinions on the forming historical trend and the world system's future configuration.

It is commonly known that the choice of forecast point has a substantial effect on its result. At this point we associate ourselves with American historian and theoretician Lipschutz R. who clearly demonstrated how the end of the Cold War led to the paralysis of an idea of national state and collapse of the previous system of international safety [6].

The study of issues related to international relations was a subject of high interest for scientists since ancient times: E.H. Carr, G. Morgenthau, L. Waltz, G. Clark, J.S. Nye, R. Cohen, H. Bull, A. Rapoport, J. Burton, E. Haas, A. Walfers, K. Wright, O. Holsty. A lot of modern scientists also deeply study the issues of international relations: R. Powell, S.A. Lantsov, M.A. Muntean, B. Buzan, J.B. Mannheim, R.K. Rich, M.A. Khrustalev, F. Moreau-Defarge, M. Kaplan and others.

Researchers of the concepts of dependent development (A. Cordova, O. Zunkel, F.Kh. Cardoso, etc.) believe that the main reason for most countries of the world is the "covert" use of the poorly economically developed countries by more advanced ones [7]. The study of international relations by K. Wright is based on the fact that they represent a body of knowledge with the help of which it is possible to assess and control the relationship between states. A. Kaminsky considers this from the position that international relations are decisive factors, levers, mechanisms of mutual relations and finds regularities and randomness in these relationships.

Concept headings. Taking into account a total absence of analogues of mathematical solution to the stated problem in literature, new analytics of system forecast of the world system's dynamics of the international relations after the Cold War's end is justified below. To this end a special discipline of predicate logic, often named logic of (binary) relations, is used. Necessary theorems are stated and proved.

Our main hypothesis is that the world system cannot have more than two points of stability represented by its synergetic and antagonistic states. The system dynamics is surprisingly simple: it either reaches one of the points and remains there for a long time or oscillates between them [8, 9].

Strange as it may seem, the suggested system forecast of Cold War's outcomes doesn't depend on the content of relations between states recorded empirically. It takes into account only structural and dynamic properties of the relations themselves [10]. That's its advantage and at the same time its drawback. The forecast's – as any mathematical model's – strength is a high

degree of credibility. The weakness is that its general conclusions require particular historical, economic and political details while explaining and forecasting specific events.

2. MATERIALS AND METHODS

Let $WS = (a, b, c, …)$ designates the world system of states denoted with symbols a, b, c, … . First of allб we're interested in possible relations between states. To this end the framework of relational algebra is used. Assuming this comment, term WS can be interpreted as a world system of international relations [11]. The analysis' long-run objective is statement of general laws the change of relations between states follow and determination of dominating trend after the Cold War's end.

Let x, y, z, … − individual variables, running the elements WS; (x), (Ex) − generality and existential quantifiers, respectively. Let signs $\neg$, $\rightarrow$, $\leftrightarrow$, $\otimes$, $\oplus$ denote complementary operations (to complete relation), entailment, equivalence, multiplication and relation addition, respectively.

Let's denote probability measure determined on the set of all subsets of the WS system with Pr. Let's set positive (P), negative (N), conflict (C), relevant (R) and irrelevant (IR) relations (impact, dependence) on Cartesian product $WS \times WS$ according to the following definitions.

Definition 1: *State a has a positive impact on state b if and only if probability of existence of b providing existence of a is more than* 0.5*: Pr(b/a) > 0.5.*

Definition 2: *State a has a negative impact on state b if and only if probability of existence of b providing existence of a is less than* 0.5*: Pr(b/a) < 0.5.*

Definition 3: *State a has no impact on state b (a is related to b irrelevantly) if and only if probability of existence of b providing existence of a is* 0.5*: IR$_{ab}$ = Pr(b/a) = 0.5.*

Definition 4: *State a has an impact on state b (a is related to b relevantly) if and only if state a has a positive or negative impact on state b: R$_{ab}$ = P$_{ab}$ ⊕ N$_{ab}$.*

Definition 5: *State a is in conflict with state b if and only if a relates to b both positively and negatively: C$_{ab}$ = P$_{ab}$ ⊗ N$_{ab}$.*

Definition 6: *States a and b are in synergetic dependence if and only if they're both related to each other only positively.*

Definition 7: *States a and b are in antagonistic dependence if and only if they're both related to each other only negatively.*

The categories of conflict, synergism and antagonism have a special role to play in the building of qualitative forecasts of system transformations. Conflict denotes the inner cause of system change, synergism and antagonism − stable, although opposite outcomes of conflict solution, its points of stability (attractors). The outbreak of a system conflict indicates the beginning of a system change, synergism and antagonism − achieving steady state of stability by the system. A conflict with the course of time either transfers the system to a higher or lower level of conflict or transforms it into a conflict-free − synergetic or antagonistic state.

The essence of synergism as a steady conflict-free system state reveals the following significant dynamic properties:

(1) States, which are elements of a synergetic system, all together either progress or regress.

(2) All synergetic systems with the course of time and continuous generation of energy from outside only increase their synergism and strive to remain, therefore, conflict-free.

(3) A synergetic system ceases to exist only when strengthening or weakening of all or several states becomes incompatible with ensuring general synergism of its components.

Antagonism as a steady conflict-free system state is characterized by the following distinctive dynamic properties:

(1) The progress of some states within antagonistic systems always takes place at the expense of other states' regress. This means that the one pole of antagonistic system prospers with the course of time, while the other one certainly comes down.

(2) All antagonistic systems with the course of time and continuous generation of energy from outside only increase its antagonism and strive to remain, therefore, conflict-free.

(3) An antagonistic system ceases to exist only when the degrading pole cannot stand its antagonism with the stronger pole anymore.

Let's name positive, negative relations and their additions to complete relations *initial*. Multiplicative unification of positive and negative relations with their additions can give rise to both relevant, i.e. positive or negative relations, and conflict and irrelevant relations as derivatives. All possible kinds of derivatives relations between states *a* and *b* based on their initial relations' multiplication is summarized in Table 1.

Table 1. All possible kinds of derivatives relations

	N_{ab}	$\neg N_{ab}$
P_{ab}	C_{ab}	P_{ab}
$\neg P_{ab}$	N_{ab}	IR_{ab}

Let *PL* denotes a pole (alliance, bloc, coalition) of the world system of states composed by its elements based on the combinations of certain kind of relations with *WS*.

Definition 8: *State a forms with state b a one-pole system if and only if a and b relate to each other only positively:* $PL_{ab} = P_{ab} \otimes \neg N_{ab}$. *The one-pole system's extensive definition is as follows:*
$$PL_{xy} = (x)(y)[(x \neq y) \rightarrow (P_{xy} \otimes \neg N_{xy})].$$
It follows from Def. 6 and Def. 8 that one-pole system can be synergetic only.

Definition 9: *State a forms with state b an antagonistic double-pole system if and only if a and b relate to each other only negatively:* $PL_a \oplus PL_b = N_{ab} \otimes \neg P_{ab}$.

The double-pole system's extensive definition is as follows:
$$PL_x \oplus PL_y = (x)(y)(z)\{[(x \neq y) \ \& \ (x \neq z)] \rightarrow [(N_{xy} \otimes \neg P_{xy})$$
$$\otimes ((N_{xz} \otimes \neg P_{xz} \otimes P_{yz} \otimes \neg N_{xz})$$
$$\oplus (N_{yz} \otimes \neg P_{yz} \otimes P_{xz} \otimes \neg N_{xz}))]\}.$$
It follows from Def. 7 and Def. 9 that double-pole system can be antagonistic only, while each pole consists of synergetically interacting elements.

Relations introduced using Def. 1÷5 can be summed up and multiplied, forming more complex relations. For the purpose of the present paper it's sufficient to determine the matrix of multiplication of the relations of various modalities (see Table 2).

Table 2. Relations of various modalities

$\otimes$	P	N	C	R	IR
P	P	N	C	R	IR
N	N	P	C	R	IR
C	C	C	C	C	IR
R	R	R	C	R	IR
IR	IR	IR	IR	IR	IR

For example, the following system of relations, despite even number of negative relations, is nonetheless conflict:

$$P \otimes N \otimes N \otimes P \otimes P \otimes P \otimes C = [P \otimes N] \otimes N \otimes P \otimes P \otimes P \otimes C$$
$$= [N \otimes N] \otimes P \otimes R \otimes P \otimes C$$
$$= [P \otimes P] \otimes R \otimes P \otimes C$$
$$= [P \otimes R] \otimes P \otimes C$$
$$= [R \otimes P] \otimes C$$
$$= R \otimes C$$
$$= C$$

It follows from Table 2 that the relation of irrelevance *IR* is the most stable: being multiplied by any relation, it always remains. It can be considered a peculiar null (dominant) relation in the logic of studied relations between states. Gaining complete independence as distinct from other types of relations offers a solution to all international problems: a state can have no difficulties in relations with neighbors, if only it exists independently of them.

The second most stable is *C* conflict relation. It dominates all types of relations, except for irrelevance relation *IR*. Conflict stability before all other dependence relations confirms a worldly wisdom: it's easy to come into conflict, but difficult to come out of it [12].

The relation of relevant (positive or negative) relationship *R* is the next in the hierarchy of stability. This combined relation dominates only positive and only negative relations, giving up in stability only to irrelevance and conflict relations.

The relationships of positive relation *P* and relevant relation *R* are reflexive, symmetrical and transitive, i.e. they're a relation of equivalence. It is two types of relations (and only them) that create a basis for emergence of a stable system of international relations. Strictly speaking, each of them is only necessary, but they can become adequate grounds for international stability if conditions are right.

The relation of negative relation *N* is neither reflexive nor transitive, but it is symmetrical. The relations of irrelevant relation *IR* and conflict *C* are not reflexive, but symmetrical and transitive. These types of relations do not form equivalence classes and in no event can ensure uprising – let alone ensuring – of stable world order.

It follows from the above that the problem of searching for stable architecture of the world system *WS* is mathematically comes to breakdown of all states into many non-crossing and jointly exhaustive classes (poles) offering equivalence. Only two relations (from the considered above) have the equivalence property – the relations of relevance *R* and positive *P* relation. It means that each of them may become not only necessary but adequate grounds for dividing the world system *WS* into non-crossing and jointly exhaustive classes if conditions are right. This result is notable on its own, since it indicates relevance (positive or negative dependence) and positive dependence of states as two indispensable and, notably, only conditions of the international relations' system stability [13].

The relations of positive (*P*) and negative (*N*) relevance represent peculiar atoms, various combinations of which give rise to all the rest types of relations (Compare Tables 1 and 3).

Table 3. The relations of positive (*P*) and negative (*N*) relevance

U = all relations		
R = relevant		*IR* = irrelevant
Conflict	Conflict-free	$(\neg P \otimes \neg N)$
$C = (P \otimes N)$	$\neg C = (P \otimes \neg N) \oplus (\neg P \otimes N)$	

Let's state the main theorems of the logic of international relations necessary for system forecast justification. However, it should be noted that in a nonformal sense the logic of relations between states is principally the same as the logic of interpersonal relations that are governed by four well-known rules of "the golden rule of morals" [1]:

1.   The friend of my friend is my friend.
2.   The friend of my enemy is my enemy.
3.   The enemy of my friend is my enemy.

4.   The enemy of my enemy is my friend.

Theorem 1: *In the world system WS states are dependent on each other if and only if it's false that they're independent on each other:*

$(x)(y) (R_{xy} \leftrightarrow \neg IR_{xy})$.

Proof:

1. $(x)(y) R_{xy}$ (assumption of direct proof)
2. $(x)(y) \neg \neg R_{xy}$ (1)
3. $(x)(y) \neg \neg [(Pr (y/x) > 0.5) \oplus (Pr (y/x) < 0.5)]$ (2, Def. 4)
4. $(x)(y) \neg [Pr (y/x) = 0.5]$ (3, Def. 3)
5. $(x)(y) \neg IR_{xy}$ (4, Def. 3)
6. The proof of converse implication is analogous. QED

According to theorem 1, dependent states form an equivalent class, the common feature (relevance of relations) of which is not typical for none independent state (see Table 3). From this perspective, being independent means having neither positive nor negative, nor conflict relations with any other state of the world system *WS*.

Theorem 2: *In the world system WS dependent states are positively related to each other if and only if it's false that they're negatively related to each other:*

$(x)(y) (P_{xy} \leftrightarrow \neg N_{xy})$.

Proof:

1. $(x)(y) P_{xy}$ (assumption of direct proof)
2. $(x)(y) \neg \neg P_{xy}$ (1)
3. $(x)(y) \neg \neg [Pr (y/x) > 0.5]$ (2, Def. 1)
4. $(x)(y) \neg IR_{xy} \otimes \neg [Pr (y/x) \leq 0.5]$ (3, assumption of dependency)
5. $(x)(y) \neg [Pr (y/x) < 0.5]$ (4, T 1)
6. $(x)(y) \neg N_{xy}$ (4, Def. 2)
7. The proof of converse implication is analogous. QED

According to theorem 2, positively related states among dependent states form their own equivalent class, the common feature of which (positive relevance) is not typical for none negatively dependent state. This theorem states that positive dependence is not the only type of dependence. There are also such types as conflict and antagonism, including not only positive but also negative relations of states.

Theorem 3: *In the world system WS pairs of dependent states are conflict-free if and only if they're related in each pair either only positively or only negatively:*

$(x)(y) \{(R_{xy} \otimes \neg C_{xy}) \leftrightarrow [(P_{xy} \otimes \neg N_{xy}) \oplus (\neg P_{xy} \otimes N_{xy})]\}$.

Proof:

1. $(x)(y) (R_{xy} \otimes \neg C_{xy})$ (assumption of direct proof)
2. $(x)(y) [(P_{xy} \oplus N_{xy}) \otimes \neg (P_{xy} \otimes N_{xy})]$ (1, Def. 4 and 5)
3. $(x)(y) [(P_{xy} \oplus N_{xy}) \otimes (\neg P_{xy} \oplus \neg N_{xy})]$ (2)
4. $(x)(y) [(P_{xy} \otimes \neg N_{xy}) \oplus (\neg P_{xy} \otimes N_{xy})]$ (3)
5. The proof of converse implication is analogous. QED

According to theorem 3, two interdependent states form an elementary dynamic cycle, which is conflict-free in two cases: either two ways of cycle are positive (synergism occurrence) or they're both negative (antagonism occurrence). It is obvious that pairwise conflict-free nature of states does not generally guarantees the conflict-free nature of the whole world system *WS*.

Theorem 4: *In the world system WS, which is in conflict, each state is in a negative self-reference:*

$(x)(y)\ C_{xy} \to N_{xч}.$
Proof:
1. $(x)(y)\ C_{xy}$ (assumption of direct proof)
2. $(x)(y)\ (P_{xy} \otimes N_{xy})$ (1, Def. 5)
3. $(x)(y)\ (P_{xy} \otimes N_{yx})$ (2, symmetry of relation N_{xy})
4. $(x)(y)\ [(P_{xy} \otimes N_{yx}) \to N_{xx}]$(theorem of logic of relations)
5. $(x)N_{xx}$ (3, 4) QED

Theorem 4 indicates a required feature of the world system's conflict state: each its element is a relation of negative converse relation with itself. It means that whatever measures a nation in such a state may take, it will only aggravate its situation, thereby, escalating the system conflict.

Theorem 5: *In the world system WS, which is conflict-free, each state is in a positive self-reference:*

$(x)\ P_{xx}.$
Proof: (*CPr* – calculus of probability)
1. $(Ex) \neg P_{xx}$ (assumption of indirect proof)
2. $(Ex)\ (N_{xx} \otimes IR_{xx})$ (1)
3. $(Ex)\ [(Pr\ (x/x) \le 0.5) \otimes (Pr\ (x) > 0)]$ (1, 2, *CP*, Def. 2)
4. $(Ex)\ [Pr\ (x/x) \le 0.5]$ (3)
5. $(Ex)\ [Pr\ (x) > 0]$ (4)
6. $(x)\ [\text{is } Pr\ (x) > 0,\ Pr\ (x/x) = 1]$ (theorem *CPr*)
7. $(x)\ Pr\ (x/x) = 1$ (5, 6)
8. Contradiction (4, 7)
9. $(x)\ P_{xx}$ (1, 8). QED

Theorem 5 indicates a required feature of the world system's conflict-free state: each its element should be in a relation of positive converse relation with itself. Theorem 5 expresses a peculiar principle of state (self) preservation. In order to prosper each state must be able to support itself, advocate its interests, maintain consistent relations with its friends and enemies.

Theorem 6. *The world system WS is conflict-free if and only if it has none negative relation:*

$(x)(y)\ (\neg N_{xy} \leftrightarrow \neg C_{xy}).$
Proof:
1. $(x)(y)\ \neg N_{xy}$ (condition)
2. $(x)(y)\ \neg N_{yx}$ (1, symmetry of relation N_{xy})
3. $(x)(y)\ (\neg N_{xy} \otimes \neg N_{yx})$ (1, 2)
4. $(x)(y)\ [(N_{xy} \otimes N_{yx}) \to P_{xx}]$ (theorem of logic of relations)
5. $(x)(y)\ P_{xx}$ (3, 4)
6. $(x)\ \neg N_{xx}$ (5, T 2)
7. $(Ex)(Ey)\ C_{xy}$ (assumption of indirect proof)
8. $(Ex)(Ey)\ (N_{xy} \otimes P_{xy})$ (2, Def. 5)
9. $(Ex)(Ey)\ [(N_{xy} \otimes P_{yx}) \to N_{xx}]$ (theorem of logic of relations)
10. $(Ex)\ N_{xx}$ (8, 9)
11. Contradiction (6, 10)
12. $(x)(y)\ \neg C_{xy}$ (7, 11)
13. The proof of converse implication is analogous. QED

The absence of negative relations in the world system *WS* is an indispensable and sufficient conditions for its conflict-free environment. This statement is fair for the admitted above assumptions on positive and negative relations as primary ones for systems of any type. However, a deeper analysis shows that a conflict is possible even when a system has only positive relations, which vary in its impact (see [1]).

Theorem 7: *The world system WS is conflict-free if and only if it has only positive relations:*
$(x)(y) (P_{xy} \leftrightarrow \neg C_{xy})$.

Proof:

Follows from the combination of Theorem 2 and Theorem 6. QED

A system that has only positive relations is synergetic. It is known that synergism can have both positive and negative effects. In the former case the system with its elements progresses, in the latter – degrades. Thus the system's conflict-free state doesn't guarantee its positive development trend.

Theorem 8: *The world system WS is conflict if and only if none of the states is independent on each other:*
$(x)(y) (C_{xy} \rightarrow \neg IR_{xy})$.

Proof:

1. $(x)(y) C_{xy}$ (assumption of direct proof)
2. $(x)(y) (N_{xy} \otimes P_{xy})$ (1, Def. 5)
3. $(x)(y) [(N_{xy} \otimes P_{xy}) \rightarrow (N_{xy} \oplus P_{xy})]$ (theorem of logic of relations)
4. $(x)(y) (N_{xy} \oplus P_{xy})$ (2, 3)
5. $(x)(y) R_{xy}$ (4, Def. 4)
6. $(x)(y) \neg IR_{xy}$ (5, T1). QED

According to theorem 8, a conflict is possible not only between dependent states. In other words, dependence is an indispensable, although not sufficient condition of conflict. Dependence between states is potential of not only conflict-free but also conflict development. If several states become members of the same economic, political or war system, they not only benefit from mutual cooperation but also increase chances for conflicts between themselves. It explains why every union, stable as it may be conceived, dissolves sooner or later.

Theorem 9: *The world system WS is conflict free if it is consists of states dependent on each other:*
$(x)(y) (IR_{xy} \rightarrow \neg C_{xy})$.

Proof:

Theorem T9 is a contraposition to theorem T8 and, therefore, is equivalent to it. QED

According to theorem 9, independence and conflict environment are incompatible system features. Theorems 8 and 9 highlight state's independence as the only guaranteed solution to any international conflict. However, this formula for establishing a stable world order can scarcely be put into practice worldwide. Achieving complete independence by all states in the foreseeable future seems a utopian project because of the evident scarcity of resources necessary for progressive development. It means that strengthening of world economy's globalization tendencies will certainly enhance the likelihood of international conflicts among its members.

Theorem 10: *If each state of the world system WS is in a positive self-reference, the system is conflict-free:*
$(x)(y) (P_{xx} \rightarrow \neg C_{xy})$.

Proof:

1. $(x)P_{xx}$ (condition)
2. $(Ex)(Ey) C_{xy}$ (assumption of indirect proof)
3. $(Ex)(Ey) (N_{xy} \otimes P_{xy})$ (3, Def. 5)
4. $(Ex)(Ey) (N_{xy} \otimes P_{yx})$ (symmetry of relation P_{xy})
5. $(Ex)(Ey) [(N_{xy} \otimes P_{yx}) \rightarrow N_{xx}]$ (theorem of logic of relations)
6. $(Ex) N_{xx}$ (4, 5)
7. $(Ex) \neg P_{xx}$ (6, T 2)
8. Contradiction (1, 7)

9. $(x)(y) \neg C_{xy}$ (2, 8). QED

According to theorem 10, positive self-reference of each state is a sufficient feature of a conflict-free state of the world system *WS*. If we translate the "positive self-reference" term into the language of international relations, it means a positive effect of state's self-regulation resulting from successful combination of system-wide and national interests.

Theorem 11: *The world system WS is conflict-free if and only if all states are dependent and each of them is in a positive self-reference:*

$(x)(y) [(P_{xx} \otimes R_{xy}) \leftrightarrow \neg C_{xy})]$.

Proof:
1. $(x)(y) (P_{xx} \otimes R_{xy})$ (assumption)
2. $(x)(y) [(P_{xx} \otimes R_{xy}) \rightarrow \neg C_{xy}]$ (T10)
3. $\neg C_{xy}$ (1, 2)
4. The proof of converse implication is analogous. QED

According to theorem 11, in case of dependence positive self-reference is not only a sufficient but at the same time necessary condition of conflict-free existence. Collapses of coalitions always start when some of its members loose positive self-reference for one reason or another. For example, *Brexit* took place when about a half of British population stopped to feel self-identification regarding membership in the EEC.

Theorem 12: *If the world system of interdependent states WS has exactly one pole, it is conflict-free:*

$(x)(y) (PL_{xy} \rightarrow \neg C_{xy})$.

Proof:
1. $(x)(y) PL_{xy}$ (assumption of direct proof)
2. $(x)(y) (P_{xy} \otimes \neg N_{xy})$ (1, Def. 6)
3. $(x)(y) [(P_{xy} \otimes \neg N_{xy}) \rightarrow \neg C_{xy}]$ (conclusion of theorem T6 and T7)
4. $(x)(y) \neg C_{xy}$ (2, 3). QED

Theorem 12 states that the absence of conflict in the community of dependent states is a necessary condition of one-pole and, therefore, synergetic systems. If the world economy achieved a complete and universally beneficial state of globalization for all *WS* states, and their political regimes and institutes corresponded to and supported it, the mentioned one-pole and synergetic word order would appear. In such a world order conflict would be impossible.

Theorem 13: *If the world system of interdependent states WS has exactly two poles, it is conflict-free:*

$(x)(y) [(PL_x \oplus PL_y) \rightarrow \neg C_{xy}]$.

Proof:
1. $(x)(y) (PL_x \oplus PL_y)$ (assumption of direct proof)
2. $(x)(y) (N_{xy} \otimes \neg P_{xy})$ (1, Def. 7)
3. $(x)(y) (N_{xy} \otimes N_{xy})$ (2, T2)
4. $(x)(y) (N_{xy} \otimes N_{xy}) \rightarrow P_{xy}$ (logic of relations theorem)
5. $(x)(y) P_{xy}$ (3, 4)
6. $(x)(y) [P_{xy} \rightarrow (\neg N_{xx} \otimes P_{xx} \otimes \neg N_{yy} \otimes P_{yy})]$ (logic of relations theorem)
7. $(x)(y) (\neg N_{xx} \otimes P_{xx} \otimes \neg N_{yy} \otimes P_{yy})$ (5, 6)
8. $(x)(y) [(\neg N_{xx} \otimes P_{xx} \otimes \neg N_{yy} \otimes P_{yy}) \rightarrow \neg C_{xy}]$ (conclusion of theorem T6 and T7)
9. $(x)(y) \neg C_{xy}$ (7, 8). QED

Theorem 13 is of important methodological value. It proves that antagonism, which everyone's prone to identify with conflict, is actually one of its (in addition to synergism)

oppositions. Like synergism, antagonism features high resistance and ceases to exist until one of antagonists dies out or stops fighting because of eclipse of powers and resources depletion. The Cold War between the Soviet Union and USA and its allies that lasted a little more than 40 years and ended only with the collapse of the Soviet Union, can be a case in point, demonstrating antagonism stability.

Theorem 14: *If the world system of interdependent states WS is polarized into one or two poles, it is conflict-free:*

$$(x)(y) [(PL_{xy} \oplus (PL_x \oplus PL_y)) \rightarrow \neg C_{xy}]$$

Proof:
Follows from the combination of theorems 12 and 13. QED

The meaning of theorem 14 is that the absence of conflict in the system of international relations of interdependent states can be a consequence of only two causes – its one-pole (synergetic) or double-pole (antagonistic) organization.

Theorem 15: *The world system of interdependent states WS is conflict-free if only it is polarized into one or two poles:*

$$(x)(y) [\neg C_{xy} \rightarrow (PL_{xy} \oplus (PL_x \oplus PL_y))].$$

Proof:
1. $(x)(y) \neg C_{xy}$ (condition)
2. $(Ex)(Ey) \neg [PL_{xy} \oplus (PL_x \oplus PL_y)]$ (assumption of indirect proof)
3. $(Ex)(Ey) [\neg PL_{xy} \otimes \neg (PL_x \oplus PL_y)]$ (2)
4. $(Ex)(Ey) [\neg (P_{xy} \otimes \neg N_{xy}) \otimes \neg (N_{xy} \otimes \neg P_{xy})]$ (3)
5. $(Ex)(Ey) [(\neg P_{xy} \oplus N_{xy}) \otimes (\neg N_{xy} \oplus P_{xy})]$ (4)
6. $(Ex)(Ey) [(N_{xy} \oplus N_{xy}) \otimes (P_{xy} \oplus P_{xy})]$ (5, T 2)
7. $(Ex)(Ey) (N_{xy} \otimes P_{xy})$ (6)
8. $(Ex)(Ey) C_{xy}$ (7, Def. 5)
9. Contradiction (1, 8)
10. $(x)(y) [PL_{xy} \oplus (PL_x \oplus PL_y)]$ (2, 9). QED

Theorem 15 is converse to theorem 14. It establishes that if the system of international relations is conflict-free, it means it is either one-pole (synergetic) or double-pole (antagonistic).

Theorem 16: *The world system of interdependent states WS is conflict-free if and only if it's polarized into one or two poles:*

$$(x)(y) [(PL_{xy} \oplus (PL_x \oplus PL_y)) \leftrightarrow \neg C_{xy}]$$

Proof:
Follows from the combination of theorems 14 and 15. QED

The important meaning of theorem 16, which can be called central one for our forecast justification, is that it determines necessary and sufficient conditions of conflict-free development of the system of international relations – synergism within one pole or antagonism between two synergetic poles. All other combinations of relations between states are knowingly conflict, i.e. induce the system to move to one of the stated points of stability.

3. RESULTS AND DISCUSSION

Forecast and its justification. Let's divide all system forecasts into qualitative and quantitative. Qualitative forecasts do not depend on historical, political, economic and cultural factors and are more significant to this effect in the degree of community of their conclusions. The credibility degree of a qualitative system forecast depends on three conditions: (1) the choice of forecast base point; (2) identification of dynamics or the main trend of the system's

change; (3) calculation of most probable outcomes of the system dynamics in a chosen period of time.

We choose the Cold War's end as base point of suggested forecast. The reasons are the following. From the system perspective, the Cold War represented antagonism of two superpowers (together with their allies) – the Soviet Union and USA. The world system *WS* was divided into two poles and according to theorem 13 was conflict-free and, therefore, a steady point of stability. Each superpower strongly tried to maintain power balance in the military, first of all, nuclear field, which gave rise to the stability effect.

However, the logic of antagonism development appeared stern and one of the antagonists – USSR eventually ceased to exist. Antagonism and the resulting division of the states' world system *WS* into two poles disappeared. However, the following 15-year domination of USA didn't make the world system *WS* more stable and predictable for one reason only: USA didn't become a powerful source of synergism for the whole world system neither in economic nor in political and military terms. On the contrary, the USA strategy focused on its isolated domination led and has been leading till now to strengthening and expansion of regional wars, emergence of new centers and waves of terrorism, and destruction of traditional states. According to theorem 16, it means that the world system *WS* reached not the "history end" but a new system conflict and consequently uprise of whirling motion to a new point of stability. *Chaotic and therefore poorly predictable movement of the world system WS from the burnt-out antagonism of two superpowers to a new point of stability – the main trend of the modern history after the Cold War's end.*

It follows from theorem 16 that the world economy can have only two points of stability– association of all (or the major part) states into one synergetic system or their dissociation no longer on the ideological basis into two antagonistic poles.

Before discussing the chances of each of these outcomes, it's reasonable to assess the resiliency of an idea popular in political and diplomatic quarters – the idea of "multipolar world", "polycentric architecture of international relations" that appeared as counterbalance to the idea of USA unconditional domination.

Let' consider the simplest example of multipolarity. Let's assume the world system *WS* consists of three states – Russia, China, and USA. Pure algebra shows that in this case four conflict-free and four conflict states are possible. Conflict-free states, in their turn, include one synergetic (all three states are friends) and three antagonistic (any two countries confront the third one) states. Therefore, the world system multipolarity is possible only as purely quantitative expansion of synergism or antagonism of its members with binding preservation of its pole number (one or two). Otherwise, when it has no poles or there are two poles, the world system becomes conflict, the sole destiny of which is to drift to new points of stability.

Thus, our theory states that there are no any other conflict-free states of the world system WS except one- or double-pole ones. The appearance of configurations with three and more poles in a conflict-free world system or the lack of any poles as long-term and stable state is impossible on the purely formal grounds.

If we take into account that negative and positive relations can vary in their impact (love-friendship-sympathy; hatred-enmity-antipathy), there are the following new opportunities [1].

Firstly, any pole of synergetic or antagonistic system without conflict occurrence can be divided into several subsets (subpoles), the members of which are positively related to each other more strongly than all the other members. Relations of incompatibility of the members of different poles can also vary within antagonistic systems, but in this case from strongly negative to weakly negative. Secondly, any synergetic or antagonistic system can coexist conflict-free with any other number of poles symmetrically independent on them.

One-pole system of international relations is a synergetic system (follows from Def. 6 and Def. 8). If synergism as a universal tendency has no any strong opposition, then what is now called "global community" would quickly emerge. However, the major obstacle to achieving this outcome by the world system is not so much significant differences in economic, political, ethnic,

religious and cultural conditions of different nations' existence, sometimes coming to their total incompatibility, as the state's need to defend its national interests, which always fatally counteracts the unconditional "victory" of panhuman interests [13].

In view of the above stated, achieving the state of universal synergism by the humanity appears an extremely unlikely outcome of the transformation of the world system of relations after the Cold War's end in the foreseeable future.

A double-pole system of international relations is an antagonistic system (follows from Def. 7 and Def. 9). So far, today there are no any prerequisites of military, economic or cultural nature, which indicate the imminence of arising two opposing world centers of forces. The economic competition of China and USA will never result in worldwide economic antagonism because of their economic interdependence, i.e. it will always be local and temporal. The similar conclusion can be made in relation to the military competition of Russia and USA. Any tendency of the world system division into two new poles will always be opposed by the tendencies of global labour and capital market formation, scarcity of resources, and consequently inevitable mutual dependence of all countries.

Thus, antagonism as a point of stability and inevitable division of the world system into two poles now and in the foreseen future can be considered not less problematic solution to its conflict of the world system of relations than universal synergism [14].

In view of the foregoing, our forecast is based on the following system regularity. If neither of the two possible points of stability is reachable in a definite period of time for a changing system, then the system most likely starts steadily oscillating (fluctuating) between them within its limits.

Forecast: after the Cold War's end the world system of states WS reached a stage of sustained oscillation between two conflict-free and equally unreachable states – unipolarity (synergism) and bipolarity (antagonism). Taking into account present tendencies counteracting to the achievement of each of the stated points of stability, this stage will last at least till the middle of the 21st century.

Empirical characteristics of the oscillation of the world system of states in a given time period will be determined by particular correlation of two counter forces, forming the basic conflict of any system, – a tendency to universal association of states into one global community and a tendency to protection of their national interests [10].

4 CONCLUSION

● There are two stable prejudices among analysts and practitioners of international relations. The both of them are related to misestimation of the conflict essence and functions in the evolution of the world system of states.

● According to the first prejudice, conflict is a solely deconstructive state, and all disputes, as a rule, unfold around searching for efficient methods of its prevention or resolution.

● According to the second prejudice, antagonism and such its important kind as war, are identified with conflict or are considered its type.

● The both prejudices can be overcome with a new theoretical approach, called *new analytics*. Conflict is considered the only condition of transformation of the world system of international relations between the points of stability (attractors); synergism and antagonism – two (and only two) steady conflict-free states.

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