76 standard inventive solutions

Abbreviations and symbols used in graphs below mean:

***S** – substance*
***F** – field*
***SIS** - Standard Inventive Solution*

1. Class 1: Building and destruction of Su-Fields

Class 1 of Standard Inventive Solutions applies to the Su-Fields that are **incomplete, complete but not working,** or **harmful**. Solution models include **constructing** and **destroying** Su-Fields.

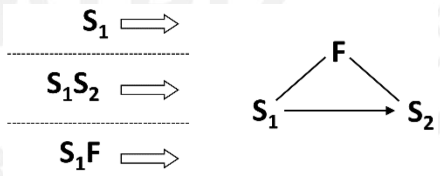
This class contains 2 sub-classes and 13 Standard Inventive Solutions. They are the following:

1.1. Synthesis of a Substance-Field System

The main idea of this sub-class is clearly reflected in SIS 1.1.1: for the synthesis of a workable technical system, it is necessary - in the simplest case - to go from incomplete Su-Field to complete Su-Field. Often, constructing the Su-Field encounters difficulties due to various restrictions on the introduction of substances and fields. Standards 1.1.2 through 1.1.8 show typical workarounds in such cases.

1.1.1. Synthesis of a Substance-Field System

*If there is an **object** that is not easy to change as required, and the conditions do not contain any limitations on introducing substances and fields, solve the problem by synthesizing an SIS, i.e., by introducing the missing element(s).*



1.1.2. Improving interactions by introducing additives into the objects

If there is a Su-Field that is difficult to be changed, and there are no restrictions on introducing additives into the available substances, the problem is being solved by transition to the internal *complex Su-Field, i.e., by introducing an internal additive to S_1 or S_2. That increases the controllability or adds the necessary properties to the Su-Field. The additive can be added permanently or temporarily.*

MATRIZ, The International TRIZ Association
founded by G. Altshuller
VAT UE: PL5252934443

Przasnyska 20A/31
01-756 Warsaw, Poland

office@matriz.org
www.matriz.org

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WA.XIV NS-REJ.KRS/49379/22/834. Sąd Rejonowy Dla m.st. Warszawy
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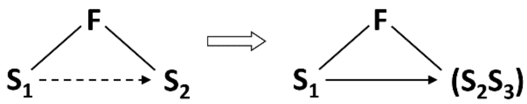
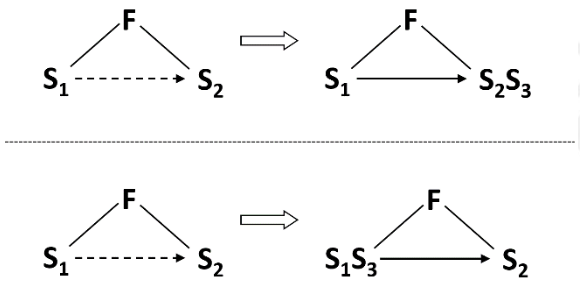


S_1 is a product, S_2 is a tool, S_3 is an additive. Brackets denote an inner compound bond (an outer compound bond is denoted without brackets).

1.1.3. Improving interactions by introducing additives into the system

If there is a Su-Field that is difficult to be changed, and there are no restrictions on introducing additives into the available substances, the problem is being solved by transition to the external complex Su-Field, i.e., by introducing an external additive to S_1 or S_2. That increases the controllability or adds the necessary properties to the Su-Field. The additive can be added permanently or temporarily.



1.1.4. Use the environment to improve interactions

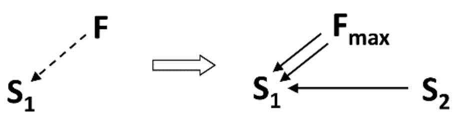
If there is a Su-Field that is difficult to be changed, and there are no restrictions on introducing additives into the available substances, the problem is being solved by introducing an additive that is a part of the environment or the supersystem.

1.1.5. Modify the environment to improve interactions

If the external environment does not contain ready substances required to synthesize a Su-Field, these substances can be obtained by replacing the external environment with another one, or by decomposing the environment, or by introducing additives into the environment.

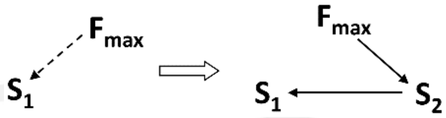
1.1.6. Providing minimal effect of action

If a minimal (measured, optimal) effect of action is required, but it is difficult or impossible to provide it under the conditions of the problem, use a maximal action (either of a field or a substance) while the excess is then removed. Substance excess is removed by a field, while field excess is removed by a substance. The excess is shown by a double line.



1.1.7. Providing maximal effect of action

If a maximal effect of action on a substance is required and this is not allowed, the maximal action has to be preserved but directed to another substance attached to the first one.



1.1.8. Use the selectively maximal mode

If a selectively maximal action is required (maximal in certain zones, while maintaining the minimal in other zones), the field should be maximal, but:

1.1.8.1. Selectively maximal mode: maximal field

In the first case, we introduce a protective substance where it is necessary to maintain minimal action.

1.1.8.2. Selectively maximal mode: minimal field

In the second case, while having the minimal mode, we selctively introduce substances that locally generate an additional field, for example, thermit compaunds – for thermal action, explosive compaunds for mechanical action.

1.2. Destroy Su-Fields

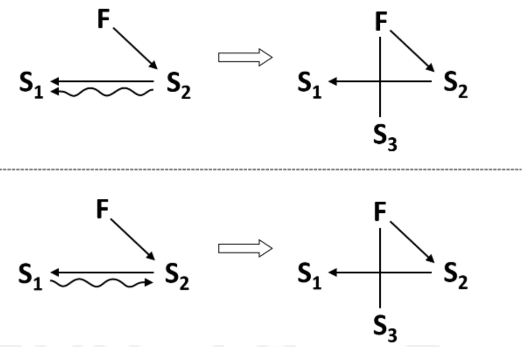
The sub-class 1.2. includes SISs for destruction of Su-Fields and the elimination or neutralization of harmful effects within them.

The strongest idea of this sub-class is the mobilization of the necessary elements through the use of the available substance-field resources.

Standard 1.2.2 is particularly important. According to it, functions of a new substance are performed by modified substances already present in the system.

1.2.1. Eliminate harmful interaction by introducing a foreign substance

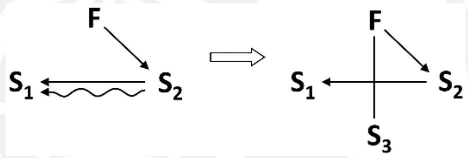
If useful and harmful actions appear between two substances in a Substance-Field System and there is no need to maintain a direct contact between the substances, solve the problem by introducing a third substance between them. The substance should be free or sufficiently cheap.



The wavy arrow indicates an action that has to be eliminated.

1.2.2. Eliminate harmful interaction by modifying existing substances

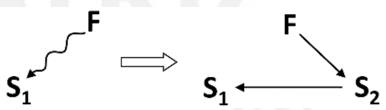
If there are useful and harmful actions between two substances, and there is no need to maintain direct contact between the substances, and it is forbidden or inconvenient to use foreign substances, solve the problem by introducing a third substance between the two. In this case, the third substance is to be a modification of the first or second substances.



<u>Note</u>: S_3 can be introduced into the system as a ready substance from the Supersystem or it can be obtained (by the action of F_1 or F_2) from S_1 or S_2. In particular, S_3 can be a „void", bubbles, foam, etc.

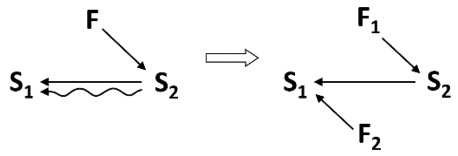
1.2.3. Eliminate harmful action of a field by introducing a sacrificial substance

If it is necessary to eliminate the harmful action of a field upon a substance, the problem can be solved by introducing a second substance that draws off upon itself the harmful effect of the field.



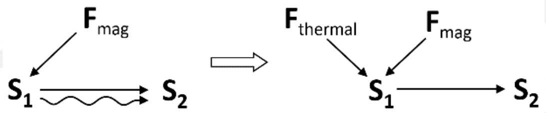
1.2.4. Eliminate harmful effects by a new counteracting field

If useful and harmful action appear between two substances in a Su-Field, and a direct contact between the substances must be maintained, the problem can be solved by transitioning to a dual Substance-Field System — the useful effect is provided by the existing field while a new counteracting field neutralizes the harmful action (or transforms the harmful action into a useful action).



1.2.5. "Turning off" a magnetic field

If it is necessary to destroy a Su-Field with a magnetic field, the problem is solved by using physical effects that are capable of "switching off" ferromagnetic properties of substances (e.g., by de-magnetizing by a mechanical impact or by heating above the Curie point).



2. Class 2: Development of Su-Fields

Class 2 of Standard Inventive Solutions is used **to improve the efficiency** of the Engineering System **by introducing minor modifications**.

This class contains 4 sub-classes and 23 Standard Inventive Solutions. They are the following:

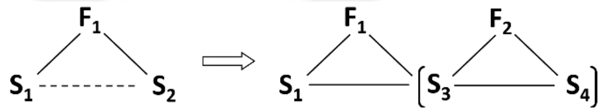
2.1. Transition to more sophisticated Su-Field

An increase of the efficiency of Su-Fields can be achieved by the transition from simple Su-Fields to more sophisticated ones - Chain and Double ones. The modifications are relatively small, while the transition ensures the emergence of new qualities and strengthening of the existing ones, primarily the controllability of the system.

2.1.1. Transition to Chain Su-Field

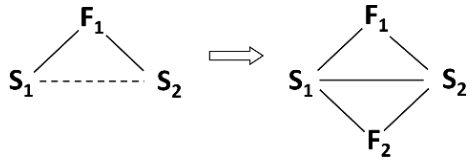
If it is necessary to increase the efficiency of the Su-Field, the problem can be solved by transforming S_1 or S_2 into an independently controlled Su-Field, thus creating a Chain Su-Field.

S_3 or S_4 can be transformed into another independently controlled Su-Field.



2.1.2. Transition to Double Su-Field

If the Su-Field is insufficient and the replacement of its elements is unacceptable, the problem can be solved by introducing a second field, hence constructing a Double Su-Field that has higher efficiency.



2.2. Intensification of Su-Fields

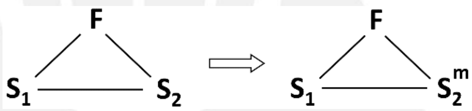
The general idea behind six SIS of this sub-class is to increase the efficiency of Su-Fields – simple or more sophisticated - without introducing any new fields or substances. This is achieved by the intensified use of the available substance-field resources.

2.2.1. Transition to more controllable fields

An efficiency of Su-Field can be increased by replacing the uncontrolled (or poorly controlled) field with a controlled (well-controlled) field, e.g., replacing the gravity field with a mechanical, mechanical-electric, etc.

2.2.2. Segmentation of the substance

An efficiency of Su-Field can be improved by increasing the degree of segmentation of S1 or S2.



Note:

- *The symbol $S^{segm.}$ denotes a substance segmented into many small particles (grains of sand, powder, granules, etc.).*
- *SIS 2.2.1 reflects one of the sub-trends of TESE, i.e, the segmentation of components.*

2.2.3. Transition to capillary-porous substance

A special case of substances segmentation is the transition from solids to capillary-porous substances. This transition is performed along the following line:

monolith substance

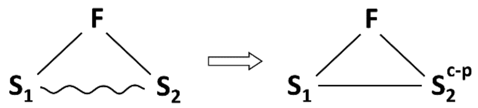
substance with one cavity

monolith with many cavities (perforated substance)

capillary-porous substance

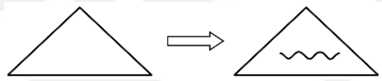
capillary-porous substance with a certain pore structure (and size)

With the development of this line, the possibility of introducing a liquid substance into cavities-pores and using physical effects increases.



2.2.4. Dynamization of the Su-Field

Efficiency of a Su-Field can be improved by increasing the degree of its dynamization, i.e., by transitioning to a more flexible, rapidly changing structure of the system.



<u>Note:</u>

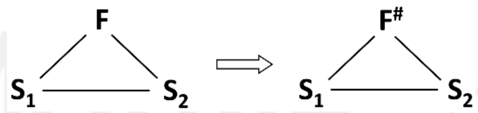
A triangular symbol with a wavy line represents a dynamic Su-Field that changes during its operation.

The dynamization of S_2 usually start with introducing a hinge. Further dynamization runs along the line: one hinge -> many hinges -> flexible substance.

The dynamization of F usuall transition from the constant F to pulsating F.

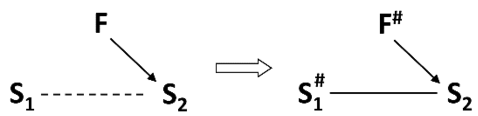
2.2.5. Changing the structure of the field

Efficiency of Su-Field can be increased by transitioning from homogeneous or unstructured field to inhomogeneous field or a field with a special structure (constant or variable in time and space).



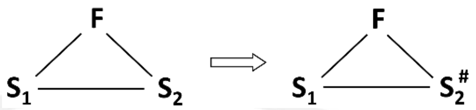
*<u>Note:</u> The **#** symbol next to the letter **F** denotes that the field has a special structure variable in time and space.*

If a substance that is a part of the Su-Field or can be a part of the Su-Field mut have a specific spatial structure, the process should be performed in a field that has a structure corresponding to the required structure of the substance.



2.2.6. Changing the structure of the substance

Efficiency of Su-Field can be increased by transitioning from homogeneous or unstructured substance to inhomogeneous substance or a substance with a special structure (constant or variable in time and space).



*<u>Note</u>: The **#** symbol next to the letter **S** denotes that the substance has a special structure variable in time and space.*

If it is necessary to obtain an intensive thermal effect in the certain places of the system (points, lines), exothermic substances should be introduced in these places beforehand.

2.3. Intensification of rhythms coordination

Sub-class 2.3 includes SISs for Su-Fields intensification in particularly economical ways. Instead of introducing or substantially changing substances or fields, the SISs provide for purely quantitative changes - frequencies, sizes, or mass. Thus, a significant new effect is achieved with minimal system changes.

2.3.1. Coordination of rhythms of the field and the substance

Efficiency of Su-Field can be improved by coordination of the frequency of the Field with the natural frequency of the Substance.

2.3.2. Coordination of rhythms of the fields that are used

In more sophisticated Su-Field, the frequencies of the Fields that are used should be coordinated.

2.3.3. Coordination of incompatible or previously independent activities

When two activities, e.g., changing and measuring, are incompatible, one activity can be performed in the pauses of the other. Important: pauses in one action should be filled with the other action.

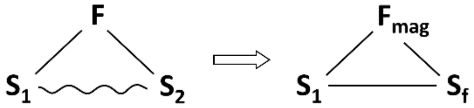
2.4. Fe-Fields (intensified sophisticated Su-Fields)

Fe-Field is a Su-Field where one of the Substances is segmented, has magnetic properties and at least one Field is electromagnetic.

Intensification can be performed through several typical ways simultaneaously. Su-Fields where the magnetis Substance is segmented is the easiest to intensify.

2.4.1. Transition to Proto-Fe-Field

Efficiency of Su-Field can be improved by using a ferromagnetic Substance (as one piece) and a magnetic Field.



Note:

This is the SIS that uses ferromagnetic Substance that is not segmented. We talk about the Proto-Fe-Field and other intermediate states.

This SIS is applicable not only for simple Su-Fields but also to complex (with an additive), as well as for Su-Fields where the additive is a part of the environment.

2.4.2. Transition to Fe-Field

Efficiency of Su-Field can be improved by transition from Su-Field or Proto-Fe-Field to Fe-Field by replacing one of the substances with ferro-particles (or adding ferro-particles like chips, granules, grains, etc.) and using a magnetic or an electromagnetic field.

The controlability grows with the increase of the degree of the ferro-particles fragmentation, so the development of Fe-Fields follows the line:

granules

powder

finely dispersed ferro-particles

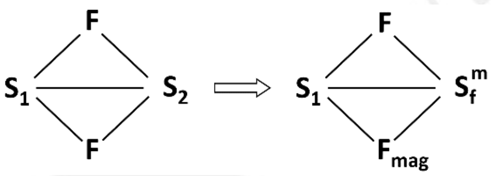
The controlability also grows with the increase in the degree of fragmentation of the substance into which the ferro-particles are introduced. The development follows the line:

monolith substance

grains

powder

liquid



Note:

Transition to Fe-Field can be considered a joint application for two SIS - 2.4.1 (Transition to Proto-Fe-Field) and 2.2.2 (Segmentation of the substance).

Having turned into Fe-Field, the Su-Field repeats the development cycle, however, at a new level, since Fe-Fields can be characterized by high controllability and efficiency. The SISs of sub-class 2.4 can be considered as types of „isotopes" of SISs of sub-classes 2.1-2.3. Singling out Fe-Fields into their own sub-

class is justified (at least at this stage of SIS development) by the exceptional practical significance of Fe-Fields. Additionally, Fe-Fields are more precise research tool for studying rougher Su-Fields and predicting their development.

2.4.3. Using ferromagnetic fluids

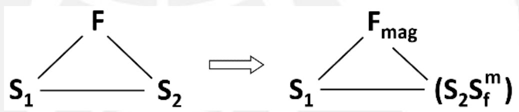
Efficiency of Fe-Field can be improved by the use of ferromagnetic fluids - colloidal ferro-particles suspended in kerosene, silicone, or water. SIS 2.4.3 can be seen as a last point in the development according to SIS 2.4.2.

2.4.4. Using capillary-porous substances in Fe-Fields

Efficiency of Fe-Fields can be improved by using a capillary-porous structure that is characteristic for many Fe-Fields.

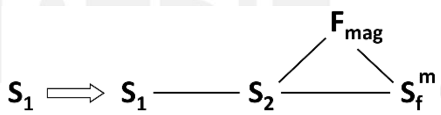
2.4.5. Transition to complex Fe-Field

If it is necessary to increase a controllability of the system by transition to Fe-Field, and the replacement of substances by ferro-particles is unacceptable, the transition is performed by introducing additives to one of the substances, hence creating an internal or external complex Fe-Field.



2.4.6. Transition to Fe-Field using the external environment

If it is necessary to increase a controllability of the system by transition from Su-Filed to Fe-Field, and replacing the substance with ferro-particles (or adding additives to the substance) is unacceptable, then the ferro-particles should be introduced into the external environment and control the system by the magnetic field, hence changing the environment parameters (SIS 2.4.3).



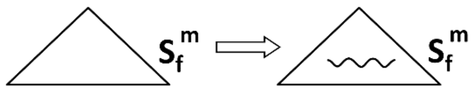
Electrorheological fluids controlled by electric fields can also be used as an external environment.

2.4.7. Using physical effects

It is possible to controll Fe-Fields using physical effects.

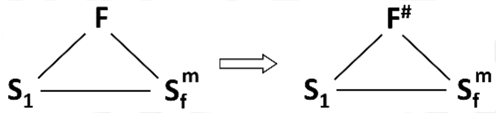
2.4.8. Dynamization of the Fe-Field

Efficiency of Fe-Field can be improved by increasing the degree of its dynamization, i.e., by transitioning to a more flexible, rapidly changing structure of the system.



2.4.9. Changing the Fe-Field structure

Efficiency of Fe-Field can be increased by transitioning from homogeneous field to inhomogeneous one or from an unstructured field or a field with a special structure (constant or variable in time and space).



2.4.10. Coordination of rhythms of the Fe-Field

Efficiency of Proto-Fe-Field and Fe-Field can be improved by coordinating rythms of its elements.

2.4.11. Transition to E-Field (Su-field with interacting electrical currents)

If the introduction of ferromagnets or magnetization of substances is difficult, the interaction of an external electromagnetic field with the direct contact, or induced currents, or the interaction of these currents with each other should be used.

<u>Note:</u>

1. *If Fe-Fields are SISs with ferromagnetic particles, then E-Fields are SISs with currents or interacting currents instead of ferromagnetic particles.*
2. *Development of E-Filed – similar to Fe-Fields – repeats the general line of Su-Field evolution:*

simple E-Field

complex E- Field

E-Field based on an external environment

dynamization

segmentation/structurization

rhythm coordination

2.4.12. Using electro-rheological liquids

A special type of E-Fields are Su-Fields with electro-rheological suspension (fine non-conducting but electrically active particles), with controlled viscosity. If the ferromagnetic fluids cannot be used, the electro-rheological suspension can be applied.

3. Class 3: Transition to Supersystem and microlevel

Class 3 of Standard Inventive Solutions applies to the Engineering Systems which **performance is insufficient**. Their efficiency is improved by developing solutions **on the different system level**.

This class contains 2 sub-classes and 6 Standard Inventive Solutions. They are the following:

3.1. Transition to bi- and poly-systems

Along with the internal improvement (SISs of Class2), there is a line of external development: at any stage of the internal development, the system can be intergrated with the supersystem components obtaining a new quality.

3.1.1. Transition to bi- and poly-systems

At any stage of the development, efficiency of Su-Field can be increased by the integration of the system with another system (or systems) into a more sophisticated bi-system or a poly-system (system transition 1a).

3.1.2. Development of links in bi-systems and poly-systems

Increasing the efficiency of the synthesized bi-systems and poly-systems can be achieved primarily through the development of links between elements of Su-Field.

The newly developed bi-systems and poly-systems often have „no links", that is, they are just a „pile" of components. The development is aimed at strengthening linking. On the other hand, elements in newly created systems are sometimes connected by rigid links. In these cases, the development is aimed at increasing the degree of dynamization of links.

no links

rigid link

flexible link

field link

3.1.3. Increasing the difference between the elements of bi-systems and poly-systems

The efficiency of bi-systems and poly-systems increases with an increase in the difference between the elements of Su-Filed (system transition 1b):

identical elements

elements with shifted characteristics

different elements

inverse combinations of the „element and anti-element"

3.1.4. Trimming of bi-systems and poly-systems

Efficiency of bi-systems and poly-systems can be improved by Trimming. Completely trimmed bi-systems and poly-systems become monosystems again. The cycle can be repeated.

3.1.5. Opposite properties of the system and its parts

Efficiency of bi-systems and poly-systems can be improved by distributing opposite properties in the system and among its parts. A two-level system is used in which the entire system has property C, and its parts (particles) have property anti-C (system transition 1c).

3.2. Transition to microlevel

There are two ways of system transition:

- *the transition to the supersystem („the way up" - SISs of subclass 3.1),*
- *the transition to microlevel („the way down" – SISs of subclass 3.2).*

3.2.1. Transition to microlevel

At any stage of development, the efficiency of the system can be improved by system transition 2: from the macro level to the micro level, when the system or its part is replaced by a substance capable of performing the required action when interacting with the field.

4. Class 4: Standard Inventive Solutions for measuring and detecting

Class 4 of Standard Inventive Solutions applies to problems of **measuring** or **detecting**.

This class contains 5 sub-classes and 17 Standard Inventive Solutions. They are the following:

4.1. Bypasses

If it is necessary to measure or detect, it is recommended that the principle of operation be changed in such a way that there is no need to measure or detect, maintaining the necessary accuracy and cost.

4.1.1. Modifying the system so there is no need to measure or detect

If it is necessary to measure or detect, it is recommendd that the system be changed in such a way that there is no need to measure or detect.

4.1.2. Measuring a copy or an image

If the problem of detection or measurement cannot be solved using SIS 4.1.1, it is recommended that the direct operation on the object be replaced with operations on its copy. For example, instead of directly measuring the logs loaded on the railway platform, the measurement is done from a photo taken on a specific scale.

4.1.3. Successive change detection

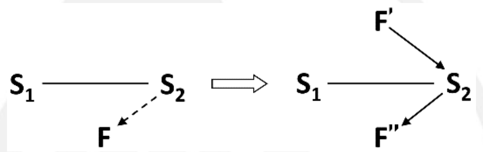
If the problem of detection or measurement cannot be solved using SISs 4.1.1 or 4.1.2, it is recommended to turn it into a successive change detection task.

4.2. Creating the measurement Su-Field

When we create Su-Fields for measurement, the strategy should be similar to the case as we create a Su-Field for improvement: complete Su-Field by introducing the missing substances or fields. The difference is that the output ot the measurement Su-Field is a field.

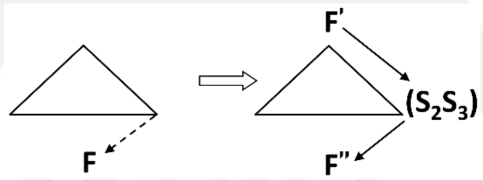
4.2.1. Creating the measurement Su-Field

If a non-Su-Field is difficult to detect or measure, the problem can be solved by creating a simple or double Su-Field with an output field.



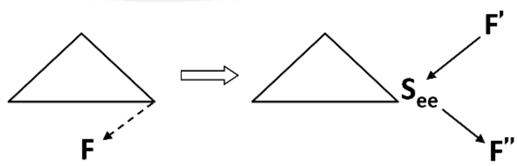
4.2.2. Transition to the complex measurement Su-Field

If the system (or part of it) is difficult to detect or measure, the problem can be solved by transition to the internal or external complex Su-Field, by introducing easily detectable additives (marks).



4.2.3. Transition to the measurement Su-Field based on the external environment

If the system is difficult to detect or measure at some point in time and it is impossible to introduce additives which create an easily detectable and easily measured field, these additives should be introduced into the external environment so that the change in the state of the system can be assessed.



4.2.4. Utilizing resources of the environment

If it is impossible to introduce the additives into the external environment (according to SIS 4.2.3), these additives can be obtained by using the resources of the environment, e.g., by decomposing it or changing its physical state (for example, gas or vapor bubbles obtained by electrolysis, cavitation, or other methods).

4.3. Intensifying measurement Su-Fields

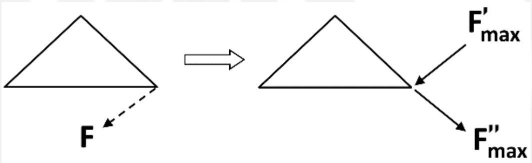
The measurment Su-Field can be intensified by applying physical effects and by coordinating the rhythm.

4.3.1. Using the physical effects

The efficiency of detecting or measuring the Su-Field can be improved by using physical effects.

4.3.2. Using the resonance of the controlled object

If changes in the system cannot be detected or measured directly and it is impossible to pass the field through the system, the problem can be solved by inducing resonance oscillations in the whole system or a part of it. Changing the oscillations frequency can help to identify changes in the system.



4.3.3. Using the resonance of the integrated object

If it is not possible to apply SIS 4.3.2, the system condition can be assessed using the change of the natural frequency of an object (in the external environment) integrated with the controlled system.

4.4. Transition to measurement Fe-Fields

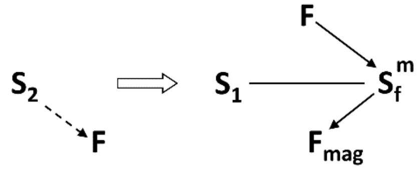
Measurement Su-FIelds strongly tend to transform into Fe-Fields.

4.4.1. Transition to measurement Proto-Fe-Fields

Su-Fields with non-magnetic fields tend to transform into Proto-Fe-Fields, that is, Su-Fields with a magnetic substance and a magnetic field.

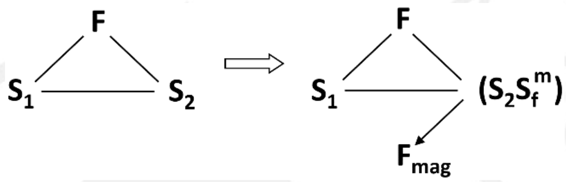
4.4.2. Transition to measurement Fe-Field

If it is necessary to increase the efficiency of detection or measurement by Proto-Fe-Field or Su-Field, it is necessary to go to Fe-Field. One of the substances can be replaced with ferromagnetic particles or the ferromagnetic additives can be used, then the magnetic field can be detected or measured.



4.4.3. Transition to complex measurement Fe-Field

If it is necessary to increase the efficiency of detection or measurement of the system by transition to Fe-Field, and replacing substances with ferromagnetic particles is impossible, then the complex Fe-Field should be created by introducing additives to the substance.



4.4.4. Transition to measurement Fe-Field based on external environment

If it is necessary to increase the efficiency of detection or measurement of the system by transition from Su-Field to Fe-Field, and the introduction of ferromagnetic particles is impossible, then the ferromagnetic particles should be introduced into the external environment.

4.4.5. Using the physical effects

If it is necessary to increase the efficiency of detection or measurement of the system, the scientific effects should be used, for example the Curie point, Hopkinson or Barkhausen effects, magnetoelastic effect, etc.

4.5. Direction of measurement Su-Fields development

The development of measurement Su-Fields is performed through the usual system transitions, but it also has its specific features.

4.5.1. Transition to measurement bi- and poly-systems

At any stage of development, the effectiveness of the measurment Su-Field can be increased by transition to a bi-system or a poly-system.

4.5.2. Transition to the measurement of derivatives

Measurment Su-Fields are developing in the floowing direction:

function measurement

measurement of the first derivative of the function

measurement of the second derivative of the function

5. Class 5: Standard Inventive Solutions on application of SISs

Class 5 of Standard Inventive Solutions gives recommendations as to how to introduce new Substances or Fields or scientific effects **more effectively** when applying SISs in the four previous classes.

This class contains 5 subclasses and 17 Standard Inventive Solutions.

5.1. Specifics of introducing substances

When creating, restructuring, or destroing Su-Fields, it is often necessary to introduce new substance. That will deacrease the ideality of the system. Therefore, substances must be „introduced without introducing" and various bypasses should be used.

5.1.1. Bypass

If it is necessary to introduce a substance into the system, and this is prohibited by the problem constraints or is unacceptable due to the operating conditions, then bypasses should be used.

5.1.1.1. Using a void instead of substance

5.1.1.2. Using a field instead of substance

5.1.1.3. Using an external additive instead of an internal one

5.1.1.4. Using very small doses of a particularly active additive

5.1.1.5. Using very small doses of a usual additive, but concentrated in separate parts of the object

5.1.1.6. Using an additive for some time

5.1.1.7. Instead of an object, use its copy (model) into which an additive can be introduced

5.1.1.8. Using the additive in the form of a chemical compound, which later released

5.1.1.9. The additive is obtained by decomposition of an external environment or the object itself, for example, by electrolysis, or by changing the state of aggregate of the external environment or the part of the object

5.1.2. Separating the product into interacting parts

If it is difficult to transform Su-Field and the problem conditions do not allow to replace the tool or to introduce additives, use the product instead of the tool, dividing it into parts that interact with each other.

5.1.3. Using a substance for a limited time

After the action, the substance introduced into the system should disappear or become indistinguishable from the substance that has previously been in the system or in the external environment.

5.1.4. Using inflatable structures and foam

If it is necessary to introduce a large amount of a substance, and this is prohibited by the system constraints or is unacceptable due to the operating conditions, use a „void" in the form of inflatable structures or foam instead of the substance.

5.2. Introducing fields

When creating, restructuring, or destroing Su-Fields, it is often necessary to introduce new fields. In order not to complicate the system, SISs of subclass 5.2 should be used.

5.2.1. Using the existing fields

If it is necessary to introduce a field into the Su-Field, first, the existing fields should be used. The substances of the Su-Field are the carriers of those fields.

5.2.2. Using the field of the external environment

If it is necessary to introduce a field into the Su-Field, and it is not possible according to SIS 5.2.1, use the fields available in the external environment.

5.2.3. Using existing substances as field sources

If it is necessary to introduce a field into the system, and it is impossible according to SISs 5.2.1 and 5.2.2, use the fields that can be generated by the substances present in the system or external environment.

5.3. Using phase transitions

Contradictory demands for introduced substances and fields can be satisfied using phase transitions.

5.3.1. Substituting the phase state of the substance

The efficiency of the substance application can be increased without introducing other substances through the phase transition 1, i.e., by changing the state of aggregate of the existing substances.

5.3.2. The dual phase-state of the substance

„Dual" properties can be provided by phase transition 2, i.e., the use of substances capable of changing from one phase state to another, depending on the operating conditions.

5.3.3. Using phenomena accompanying the phase changes

The efficiency of the system can be improved by phase transition 3, i.e., the use of phenomena accompanying the phase transition.

5.3.4. Transition to the two-phase state of the substance

The „dual" properties of the system can be provided by a phase transition 4 - replacement of a single-phase state by a two-phase state.

5.3.5. Using interactions between parts (phases) of the system

The system efficiency obtained as a result of phase transition 4 can be increased by introducing an interaction (physical, chemical) between parts (or phases) of the system.

5.4. Specifics of using the scientific effects

Many SISs provide for the use of scientific effects or can be used together with them. In this case, it is necessary to consider some techniques that increase the effectiveness of the scientific effects application.

5.4.1. Using the reversible physical transformations

If an object must periodically be in different physical states, then the transition should be accomplished by the object itself by means of reversible physical transformations, e.g., phase transitions, ionization-recombination, dissociation-association etc.

5.4.2. Strengthening the output field

If a strong output action is required while the input action is weak, the converter-substance should be brought to a near critical state. Energy is stored in the substance and the input signal acts as a „trigger".

5.5. The experimental SISs

5.5.1. Obtaining the substance particles by decomposition

If particles of the substance (i.e., ions) are needed to solve the problem, and their direct generation is impossible due to the problem constraints, then the required particles must be obtained by destroying a substance of a higher structural level (i.e., molecules).

5.5.2. Obtaining the substance particles by combining

If particles of the substance (i.e., molecules) are needed to solve the problem and it is impossible to obtain them directly or according to SIS 5.5.1, then the required particles have to be generated by completing or combining particles of a lower structural level (i.e., ions).

5.5.3. The simplest methods to obtain the substance particles

When applying SIS 5.5.1, the simplest way is to destroy the nearest higher „whole" or „excess" (negative ions) level, while when using SIS 5.5.2, the simplest way is to complete combining the nearest lower „non-whole" level.