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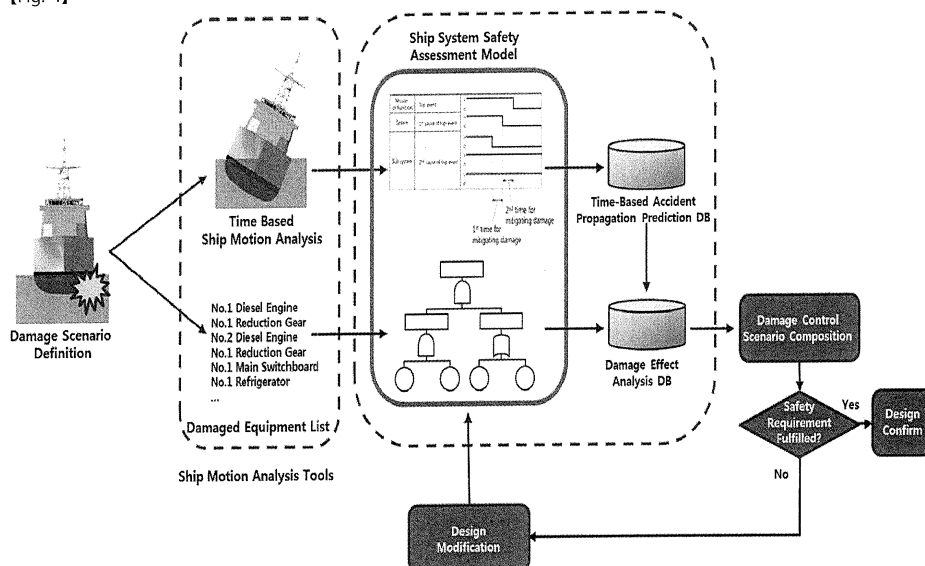
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(54) **METHOD FOR PREPARING SHIP SAFETY ASSESSMENT MODEL AND CARRYING OUT SHIP SAFETY ASSESSMENT USING SAME**

(57) Disclosed is a ship safety assessment model and a method using the same, in connection with a process of ship safety assessment that must be conducted for designing novel ships or performing an alternative design that disagrees with the existing rules or standards,

capable of supporting fast and iterative safety assessment under consideration with the characteristics of design that is performed within the limits of time and estimate, and enabling stakeholders to highly understand a result of the ship safety assessment.

[Fig. 4]



Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] The present invention relates to a ship safety assessment model and a method using the same, in connection with a process of ship safety assessment that must be conducted for designing novel ships or performing an alternative design that disagrees with the existing rules or standards, capable of supporting fast and iterative safety assessment under consideration with the characteristics of design that is performed within the limits of time and estimate, and enabling stakeholders to highly understand a result of the ship safety assessment.

2. BACKGROUND ART

[0002] In designing novel ships or performing an alternative design disagreeing with the existing rules or standards, it is necessary to assess ship safety relevant to human life, environment, fortune, and essentially verify that the novel ship is superior to a conventional ship in safety.

[0003] For this, IMO MSC/Circ 1212 and 1002 propose conceptual methods for safety admission of alternative design plans and official IMO safety assessment guidelines (FSA guidelines) propose risk-based rule development methodology for developing novel ships. In Europe, for the purpose of securing the initiative to novel ship development and alternative design, risk-based design methodology, processes, and tools, which are usable for novel ship development and alternative design, are developed to first occupy the market. However, those risk-based methodology, processes, and tools have several problems in applying them to practical ships.

[0004] First, those risk-based methodology and processes are regarded as having high abstract and difficult for a designer in performing safety assessment. To use the risk-based approach, it needs a HAZID work for identifying dangerous elements. But this needs an expert's idea because of insufficient data and different knowledge levels and standpoints of various experts cause reliability and transparency to be testified with a result of identifying dangerous elements.

[0005] Furthermore, in utilizing tools for the risk-based design, an iterative operation is performed during the design and a process to be reflected to a result of the design must be repeated. During this, since complex and difficult utilization process and long analyzing time with the conventional tools could be dangerous to exceed the limits of design estimate and time, it increases the risk of failing a project.

[0006] Furthermore, as for a shipyard, it is even difficult to provide design plans and reports, which include intellectual property such as knowhow of the shipyard, for the sake of safety assessment.

[0007] Furthermore, as for a ship, relevant to the characteristics of a single accident that propagates with its effect in a time interval without directly affecting missions and functions of the ship, such an accident propagation time is still not considered during the ship safety assessment. The accident propagation time needs to be sufficiently considered as a significant time capable of preventing accident propagation while forming an alternative design during safety assessment or minimizing damage of the accident.

SUMMARY OF THE INVENTION

[0008] In performing ship safety assessment by utilizing data, information, and knowledge which are insufficient at the beginning of design, embodiments of the present invention are directed to provide a ship safety assessment model and a method using the same, capable of enabling stakeholders, such as shipyard, class, equipment maker, shipowner, and so on, which perform ship safety assessment without remarkably modifying an established design process and stay in different knowledge levels and standpoints about ship safety, to plainly confirm considerations related to a novel ship, which is being designed, and safety thereof, enabling the stakeholders to confirm whether a ship can work a mission, in consideration of a duration time according to a behavior of the damaged ship by regarding the characteristics of the ship against identified risks and accidents, and then form various alternative design plans, supporting to efficiently perform ship safety assessment in a short design period by way of iterative safety assessment and design application, and enabling design knowhow of the shipyard to be sufficiently protected during the safety assessment.

[0009] In one embodiment, a ship safety assessment model and method using the same may include: a first step of hierarchically defining a ship with mission, function, system, and subsystem and making the ship safety assessment model that is formed in a table that materializes the mission, the function, the system, and the subsystem into terms of input, output, control, mechanism, location, limitation, duration time, and dependency; and a second step of defining an accident scenario at a first design step for the ship, substituting a ship behavior analysis result, which corresponds to the accident scenario, for the ship safety assessment model, and iteratively modifying a design plan by determining a mission capability in view of the ship and by confirming whether a safety requirement is satisfied.

[0010] The second step may be configured to form a timing diagram that represents the mission capability into Possible (1) and Impossible (0) in view of the ship in accordance with the ship behavior analysis result against the accident scenario, by means of information about the duration time and the dependency of the ship safety assessment model.

[0011] The second step may be configured to utilize

the ship safety assessment model together with a ship product model by way of the system and subsystem or location codes of the ship safety assessment model or location.

[0012] Embodiments of the present invention may further include a third step of forming a prediction database by the accident scenario with reference to the ship safety assessment model after settling a ship design.

[0013] During this, the third step may be configured to detect and cope with a predictable risk by means of the database if a substantial accident happens in a ship operation step, and continuously correct and revise the database by reflecting substantial accident information to the database and a subsequent ship design.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] These and other features, aspects and advantages of the present invention will become better understood with regard to the following description, appended claims and accompanying drawings where:

Fig. 1 schematically illustrates a hierarchical structure with missions, functions, systems, and subsystems of a ship by utilizing IDEF0 in a ship safety assessment model according to embodiments of the present invention;

Fig. 2 shows a configuration of missions, functions, systems, levels and inputs of subsystems, outputs, controls, mechanisms, which form a ship safety assessment model;

Fig. 3 exemplarily shows a configuration formed in tables of ship safety assessment model according to embodiments of the present invention;

Fig. 4 schematically illustrates a feature of iteratively evaluating safety of a design plan with a ship safety assessment model at the first design step and then improving the design plan in accordance with embodiments of the present invention;

Fig. 5 schematically illustrates how to represent a timing diagram after reflecting an accident propagation process to a duration time of the ship safety assessment model on the basis of a ship behavior analysis result about a specific accident scenario in accordance with embodiments of the present invention;

Fig. 6 schematically illustrates a ship safety assessment model to represent propagation of an accident, which occurs in a ship, into the forms of Fault Tree (FT) and Timing Diagram (TD) as Impossible (1) and Impossible (0) for missions and functions in accordance with embodiments of the present invention;

Fig. 7 illustrates a feature of representing data, which correspond to 'duration time' (damage propagation time), into the form of Fault Tree (FT) and Timing Diagram (TD) in a ship safety assessment model according to embodiments of the present invention;

Figs. 8 and 9 schematically illustrate features of utilizing a ship safety assessment model together with a ship product model by using location codes or serial numbers of systems and subsystems of the ship safety assessment model as attribute data in accordance with embodiments of the present invention; and

Fig. 10 illustrates features of utilizing a ship safety assessment model, which is implemented in a computing system, and correlating the ship safety assessment model for improvement of ship safety in accordance with embodiments of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The invention relates to a method and apparatus for reducing interference in a positioning system. In the following description, numerous specific details are set forth to provide a more thorough description of embodiments of the invention. It will be apparent, however, to one skilled in the art, that the invention may be practiced without these specific details. In other instances, well known features have not been described in detail so as not to obscure the invention.

[0016] Embodiments of the present invention may provide a ship safety assessment model and a method using the same, in designing novel ships or performing an alternative design disagreeing with the existing rules or standards, capable of enabling ship safety, which is involved in human life, environment, estimate, and so on, to be efficiently evaluated. Embodiments of the present invention may be implemented through first to third steps. Hereinafter, the embodiments of the present invention will be described in detail with reference to the accompanied drawings by step.

First step

[0017] In designing a novel ship or practically using an alternative design that disagrees with an existing rules or standards, it essentially needs to verify, by way of safety assessment, that the novel ship or a design plan is safer than a ship or plan following the existing rules or standards.

[0018] However, the safety assessment for verifying safety of a ship has problems with insufficient accident data which is available, and incapability of establishing and adopting all kinds of accident scenarios.

[0019] Further, as all design processes are inevitably limited to 'cost' and 'time', iterative works, which evaluates safety of a design plan and revises the design plan

would, eventually cause design time and cost to increase to raise a degree of failure of a project.

[0020] A ship safety assessment model according to embodiments of the present invention may be provided to solve such problems, by which ship safety is evaluated to determine whether a ship can perform a given mission or function under a specific damage circumstance.

[0021] In forming such a ship safety assessment model, it needs to concretely define a ship to which the ship safety assessment model is applied. Embodiments of the present invention may employ four elements of mission, function, system, and subsystem.

[0022] In a ship safety assessment model according to embodiments of the present invention, a ship may be defined in a hierarchical structure with mission, function, system, and subsystem. In detail, a mission (or task) of a ship is first defined, a function for performing the mission is next defined, and then a system and a subsystem, which form the function, are defined. These levels of mission, function, system, and subsystem may be concretized into the terms of input, output, control, and mechanism.

[0023] For this configuration, as can be seen from an embodiment of Fig. 1, the Integration DEFinition technique (IDEF0) may be employed. By utilizing frames of IDEF0, it may be allowable to represent a structure, which is formed of mission, function, system, and subsystem of a ship, in view, and intuitively and simply show various elements (related rules, standards, laws, estimates, schedules, persons in charge, assigned facilities, companies, departments, etc.) like the table as can be seen from an embodiment of Fig. 2.

[0024] However, these IDEF0 frame may not fully reflect all characteristics of a ship thereto, because confirming safety against many accidents occurring in a ship further needs: information about equipment placed in a position where an accident occurs (Location); an operation range of equipment to confirm whether the equipment becomes incapable due to vertical acceleration, heel or trim of a hull which is caused by an accident such as flooding (Limitation), a time taken to affect the upper level mission, function, and system which are variable by a pattern of flooding or flooding propagation (Duration time), and an effect of incapable equipment to the upper level mission, function, and system (Dependency).

[0025] Therefore, embodiments of the present invention add the terms of location, limitation, duration time, and dependency to the aforementioned ship safety assessment model, and make this model in the form of table as shown in Fig. 3. An embodiment of Fig. 3, if a mission of a ship is set to 'Safe Shipping', shows a ship safe assessment model including functions, systems, and subsystems which form the mission.

Second step

[0026] As aforementioned, if the ship safety assessment model is completely made out, ship safety assessment is carried out to define a specific accident scenario

at the first ship design step and substitute a ship behavior analysis result of the accident scenario for the ship safety assessment model. During this, the ship behavior analysis result, such as the characteristics about flooding and behavior of a ship, may be derived by means of an external commercial program or in-house program. If there is come out data for the characteristics about flooding and behavior of a ship to the specific accident scenario, the values may be recorded (substituted) into the ship safety assessment model of the table proposed in Fig. 3.

[0027] Safety assessment at this step may be carried out to determine a capability of performing a mission in view of a ship and confirm whether it satisfy a safety requirement. It may be preferred to iteratively modify a design plan in accordance with a result of the assessment. Fig. 4 schematically illustrates a feature of iteratively evaluating safety of a design plan with a ship safety assessment model at the first design step and then improving the design plan.

[0028] If it is impossible to perform a mission and function of a ship when substituting a specific accident scenario, an alternative design may be proposed to overcome the shortness. During this, the alternative design (pluralization of equipment, change of location, etc.) may be carried out to interrupt further propagation of an accident and lessen damage therefrom by considering contexts about flooding, change of behavior or mission, limitations to mission, function, system, and subsystem along time, and then the safety assessment may be repeated while reflecting the alternative design to the ship safety assessment model. During this safety assessment, the ship safety assessment model may be also used for explaining the ship to a safety valuator in view of mission and function thereof, recording safety assessment service contents, and deriving processes for improvements therefrom.

[0029] Meanwhile, in performing the safety assessment at this step, information about duration time and dependency of the ship safety assessment model is used to form a timing diagram for representing a mission completing capability into 1 (Possible) and 0 (Impossible) in view of the ship in accordance with a ship behavior analysis result against a specific accident scenario. Fig. 5 schematically illustrates how to represent a timing diagram after reflecting an accident propagation process to a duration time of the ship safety assessment model on the basis of a ship behavior analysis result about a specific accident scenario.

[0030] In representing capabilities of mission, function, system, and subsystem into probabilities which are made of some values, there could be many troubles and arguments about references at a design step. For that reason, the ship safety assessment model according to embodiments of the present invention is designed to be without such troubles and arguments by utilizing defined mission, function, system, subsystem, input, output, control, mechanism, location, dependency, duration time, and limitation and then representing a timing diagram where

capabilities of performing missions and functions of the ship to a specific damage scenario are expressed in 1 (Possible) and 0 (Impossible). Based on this timing diagram, stakeholders participating in the safety assessment may be able to understand, objectively, clearly, and intuitively, effects to missions and functions of the ship against a specific accident scenario, regardless of their knowledge levels and standpoints about ship and safety.

[0031] Meanwhile, the aforementioned work may be allowable because the ship safety assessment model may utilize information about location, dependency, duration time, and limitation to represent propagation of damage, which occurs in the ship, in the form of Fault Tree (FT) or Timing Diagram (TD), as shown in Fig. 6, with Possible (1) and Impossible (0) for mission and function.

[0032] For example, if there is a broken hole in a compartment Zone1 and a system Equip1 is disabled due to flooding after a time Time1, the upper functions related to the system Equip1 in AND logic after the time Time1 may be all turned to be impossible (0). Additionally, if heel or trim becomes over a limitation of a system Equip2 due to a behavior change of the ship after a time Time2, the upper functions related to the system Equip2 in AND logic after the time Time2 may be all turned to be Impossible (0). For these two cases, missions related to the functions that are turned to be Impossible (0) are also turned to be Impossible (0) in all. In this case, an alternative design for improving ship safety may need a work to block flooding in the time Time1, double the system Equip1 that is in flooding, or change an installation location of the system Equip1. And, it may be necessary to revise trim or heel of the ship in the time Time2 or reflect constitution of a new system to compensate an attitude change of the system Equip2.

[0033] Meanwhile, data about 'duration time' in the ship safety assessment model at this step may be obtained by analyzing a flooding context to a specific accident scenario in use of information about type and compartment of a designed ship (utilizing commercial or external programs). Then, the ship safety assessment model may be represented into the form of Fault Tree (FT) or Timing Diagram (FD) as shown in an embodiment of Fig. 7. Therefore, it may be permissible to confirm, how damage of the ship affects specific systems and subsystems and affects functions and missions of the ship after a lapse of time, in the form of Possible (1) and Impossible (0). This confirmation will be adopted to modify a new design for improving safety of the ship as stated above.

[0034] Meanwhile, in performing the safety assessment at this step, the ship safety assessment model may be utilized together with a ship product model, intermediating information about systems and subsystems or location codes of the ship safety assessment model, so that it is possible to achieve the safety assessment more objectively and practically. Figs. 8 and 9 schematically illustrate features of utilizing a ship safety assessment model together with a ship product model by using loca-

tion codes or serial numbers of systems and subsystems of the ship safety assessment model as attribute data.

Third step

[0035] After settling a ship design, a prediction database (hereinafter referred to as 'database') by accident scenario may be formed with reference to the ship safety assessment model.

[0036] During this, the database may be efficiently used to predict and prepare a risk when an accident substantially happens in a ship operation step. According to embodiments of the present invention, since substantial accident information of the ship operation step is reflected, continuously corrected and revised, and provided to the subsequent ship design, the ship safety assessment model may be evolved toward further objective and practical assessment means along time.

[0037] While an embodiment of the present invention may be implemented as a ship safety assessment model is simply formed in a form of Excel table according to the number of accident scenarios to be evaluated, it may be preferred for a large ship with many compartments and mounted devices to have a computing system for the ship safety assessment model. In this case, results about assessment and design modifications which are repeated may be coupled with the database that stores them by version.

[0038] Fig. 10 illustrates features of utilizing a ship safety assessment model, which is implemented in a computing system, and correlating the ship safety assessment model for improvement of ship safety. The contents stored in the database after performing safety assessment at a design step may be used for rendering an onboard director, who is in charge of controlling damage or commanding a takeoff by way of decision, to manage them as means for quickly, but briefly, recognizing and coping with an accident if the accident happens during a substantial operation step. The series of results may be utilized for modifying a manual for damage treatment and improving ship safety.

[0039] Consequently, the ship safety assessment model according to embodiments of the present invention may be regarded as a tool for verifying safety of a designed ship at a design step and performing, stably and quickly, an iterative process to modify the prior design. Additionally, the ship safety assessment model according to embodiments of the present invention may be regarded as a tool necessary for objectively combining different ideas of stakeholders, such as assessment-associated shipyard, class, skin, equipment maker, and so on, who would differently observe effects against a ship with a specific accident scenario due to shortness of accident data that is available at a safety assessment step.

[0040] In view of the above, embodiments of the present invention, in performing ship safety assessment by utilizing data, information, and knowledge which are insufficient at the beginning of design enables stakehold-

ers, such as shipyard, class, equipment maker, shipowner, and so on, which perform ship safety assessment without remarkably modifying an established design process and stay in different knowledge levels and standpoints about ship safety, to plainly confirm considerations related to a novel ship, which is being designed, and safety thereof, enables the stakeholders to confirm whether a ship can work a mission, in consideration of a duration time according to a behavior of the damaged ship by regarding the characteristics of the ship against identified risks and accidents, and then form various alternative design plans, supports to efficiently perform ship safety assessment in a short design period by way of iterative safety assessment and design application, and enables design knowhow of the shipyard to be sufficiently protected during the safety assessment.

[0041] As various changes can be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. The invention is defined by the claims and their full scope of equivalents.

Claims

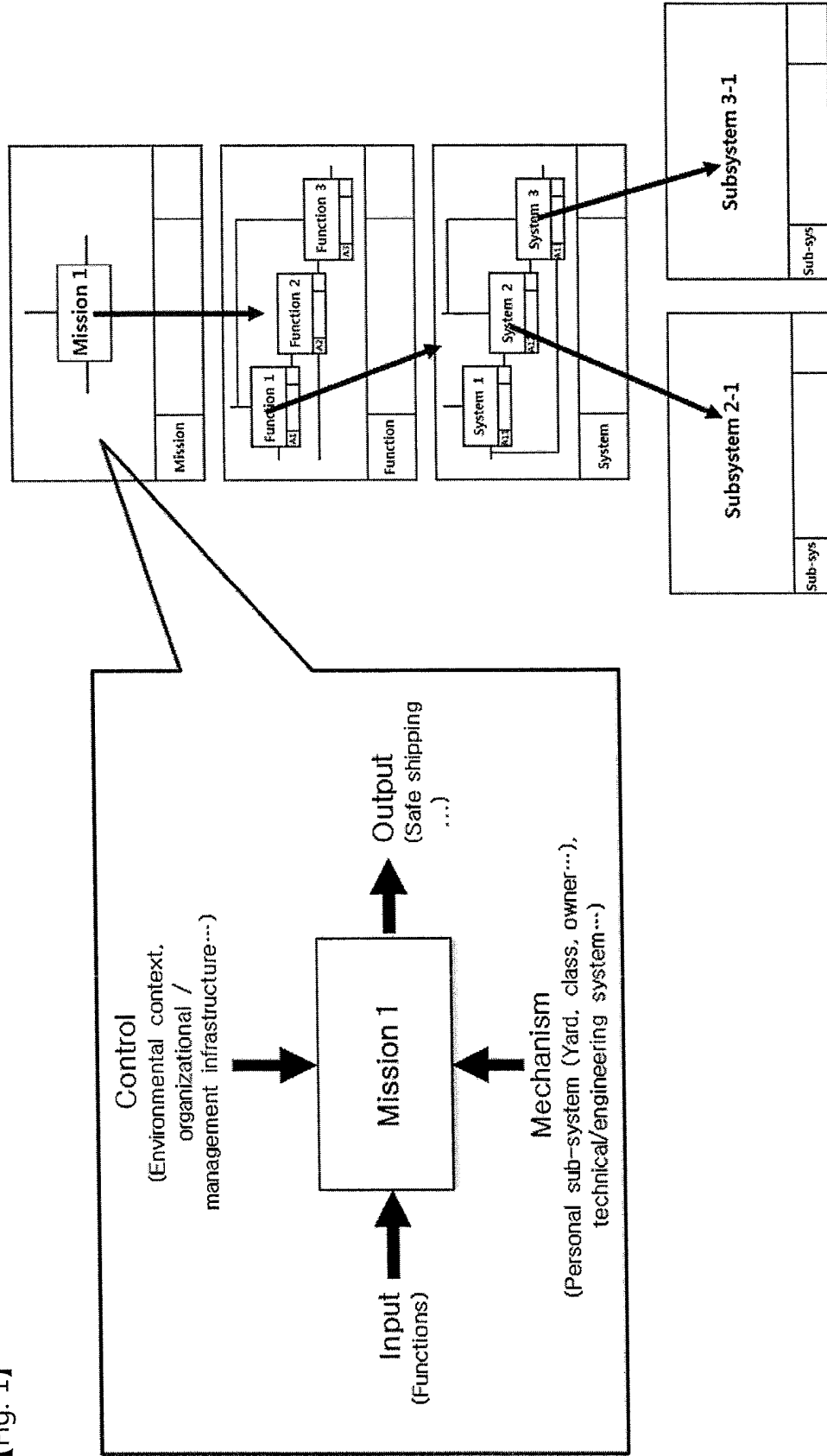
1. A ship safety assessment model and method using the same, comprising:

hierarchically defining a ship with mission, function, system, and subsystem and making the ship safety assessment model that is formed in a table that materializes the mission, the function, the system, and the subsystem into terms of input, output, control, mechanism, location, limitation, duration time, and dependency; defining an accident scenario at a first design step for the ship, substituting a ship behavior analysis result, which corresponds to the accident scenario, for the ship safety assessment model, and iteratively modifying a design plan by determining a mission capability in view of the ship and by confirming whether a safety requirement is satisfied; and forming a prediction database by the accident scenario with reference to the ship safety assessment model after settling a ship design, wherein the hierarchically defining and making is configured to make up the ship safety assessment model by utilizing a frame of an Integration DEFinition (IDEF0) technique, wherein the defining, substituting and iteratively modifying is configured to form a timing diagram that represents the mission capability into Possible (1) and Impossible (0)m in view of the ship in accordance with the ship behavior analysis result against the accident scenario, by means

of information about the duration time and the dependency of the ship safety assessment model, as well as configured to utilize the ship safety assessment model together with a ship product model by way of the system and subsystem or location codes of the ship safety assessment model or location,

wherein the forming the database is configured to detect and cope with a predictable risk by means of the database if a substantial accident happens in a ship operation step, and continuously correct and revise the database by reflecting substantial accident information to the database and a subsequent ship design.

【Fig. 1】



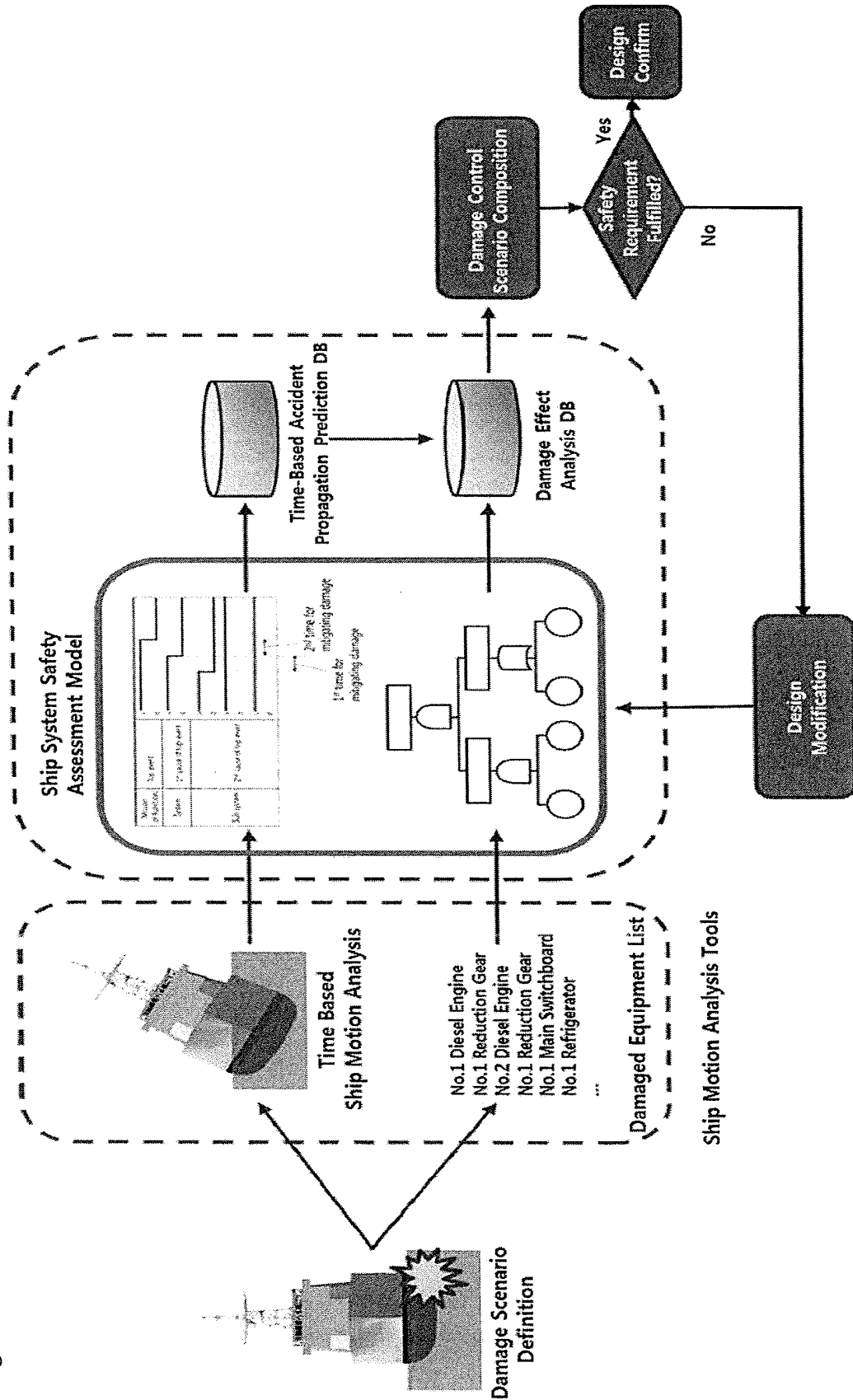
【Fig. 2】

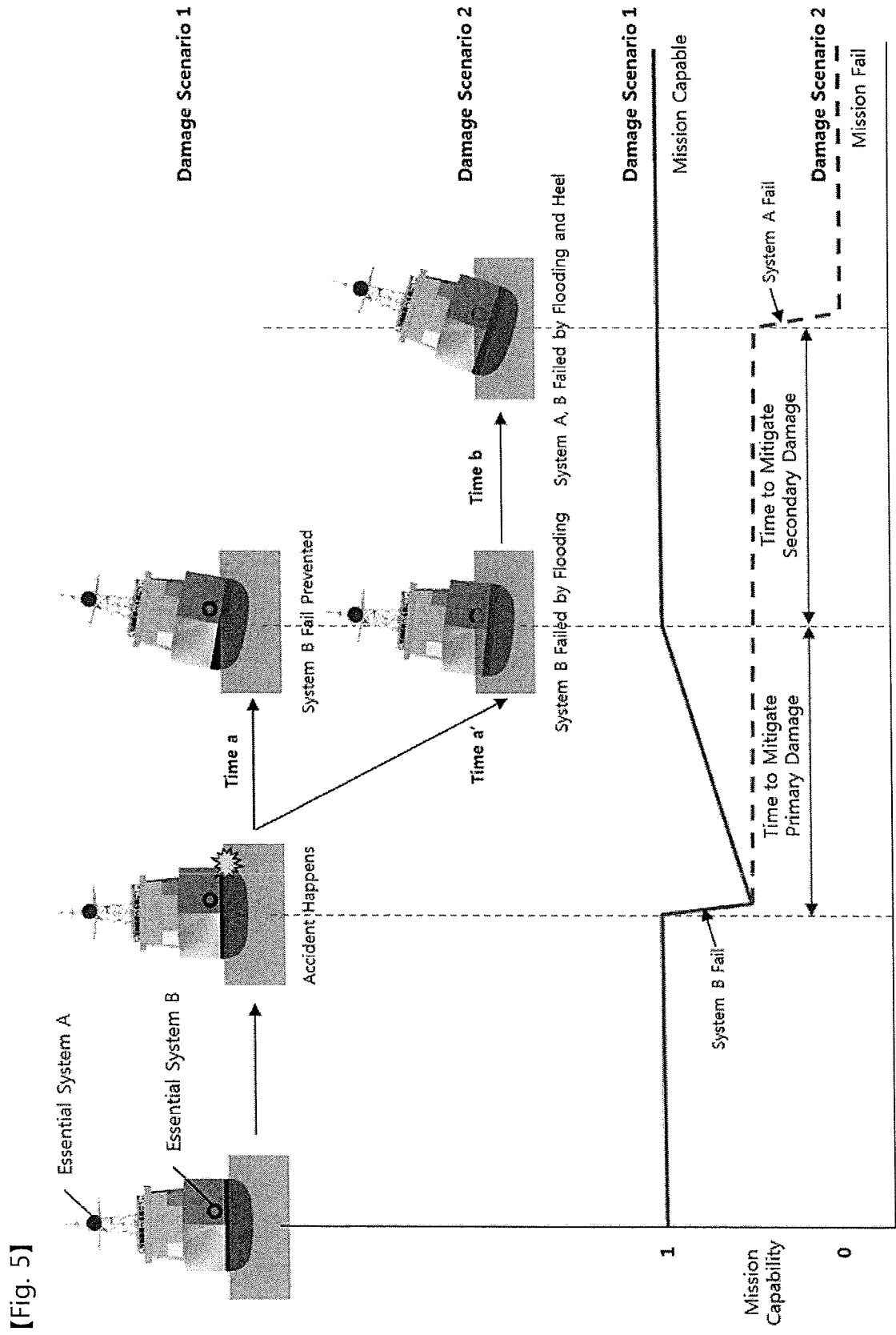
Level		Input	Control	Output	Mechanism
Level 1	Mission	Linked Functions to the Mission Ex) Functions	Points to be Considered at Each Level Ex) The environmental context, organizational/management infrastructure, personal subsystem at the Level including rules and regulations...	Mission Capability	Stakeholders in Design, Inspection, Operation Aspects at Each Level Ex) Designers, Owners, Equip. Makers, Classification Societies...
Level 2	Function	Linked Technical/engineering Systems to the Function Ex) Systems		Inputs of Upper Level Ex) Mission...	
Level 3	System	Linked Technical/engineering Sub-systems to the System Ex) Sub-systems		Inputs of Upper Level Ex) Functions...	
Level 4	Sub-system	Linked Technical/engineering Sub-systems to the Sub-system Ex) Other sub-systems		Inputs of Upper Level Ex) Systems...	

【Fig. 3】

Mission	Input	Control	Output	Mechanism	Duration Time from Func. Failure
Mission of a ship; Ex) M1.1 Safe Shipping	Linked Functions to the Mission; Ex) F1.1 Maneuverability	Points to be Considered; Ex) C1.1 Rules & Regulation C1.2 Sea Route C1.3 ...	Mission Capability; Ex) O1.1 Safe of Life O1.2 Safe of Environment O1.3 Safe of Property	Stakeholders in design, inspection, operation aspects; Ex) M1.1 Road M1.2 Gas M1.3 Owner	Time to Failure from Lower-level failure; Ex) T1.1.0 min. from F1.1 Failure T1.2 90 min from F2 Failure ...
Function	Input	Control	Output	Mechanism	Duration Time from Sys. Failure
Functions for Mission; Ex) F1.1 Maneuverability	Linked Technical/Engineering Systems to the Functions; Ex) S1.1.1 Propulsion...	Points to be Considered; Ex) C1.1.1 SOAS E-1, E-2 C1.1.2 KR rules C1.2.1 Control vectors "	Inputs of Upper Level(Mission); Ex) M1 "	Stakeholders in design, inspection, operation aspects; Ex) M1.1.1 DSM M1.1.2 K M1.1.3 MABSF ₁₀	Time to Failure from Lower-level failure; Ex) T1.1.1.0 min. from S1.1.1 Failure T1.1.2 0 min from S1.1.2 Failure "
System	Input	Control	Output	Mechanism	Duration Time from Sub Sys. Failure
Systems for Function; Ex) S1.1.1 Propulsion	Linked Technical/Engineering Sub-systems to the System; Ex) SS1.1.1.1 Engines SS1.1.1.2 Header "	Points to be Considered; Ex) C1.1.1.1 KR RA-05-K KR RA-05-K C1.1.1.2 Northern Sea Route C1.1.1.3 IM deliver...	Inputs of Upper Level(Function); Ex) F1.1.1.	Stakeholders in design, inspection, operation aspects; Ex) M1.1.1.1 Design Team No.4 M1.1.1.2 Machinery Survey Team M1.1.1.3 K DSM ₁₀	Time to Failure from Lower-level failure; Ex) T1.1.1.1 90 min. from SS1.1.1.1 Failure T1.1.1.2 90 min from SS1.1.1.2 Failure "
Sub-system	Input	Control	Output	Mechanism	Limitation
Sub-systems for Function; Ex) SS1.1.1.1 Engines	Linked Technical/Engineering Sub-systems to the Sub-system; Ex) SS1.1.1.1.1 E20.5 Tank SS1.1.1.1.2 Pumps SS1.1.1.1.3 headers "	Points to be Considered; Ex) C1.1.1.1.1 KR SA-05-K C1.1.1.1.2 Northern Sea Route C1.1.1.1.3 0.7M deliver...	Inputs of Upper Level(Subsystem); Ex) S1.1.1.1.	Stakeholders in design, inspection, operation aspects; Ex) M1.1.1.1.1 Manager ODO M1.1.1.1.2 Surveyor XXX M1.1.1.1.3 Supervisor ODO "	Operational limit of heel, trim and vertical accelerations; Ex) Heel > 15 Degreee "
					Location of systems and subsystems; Ex) R032, R033, R034.
					Location of systems and subsystems; Ex) R032...

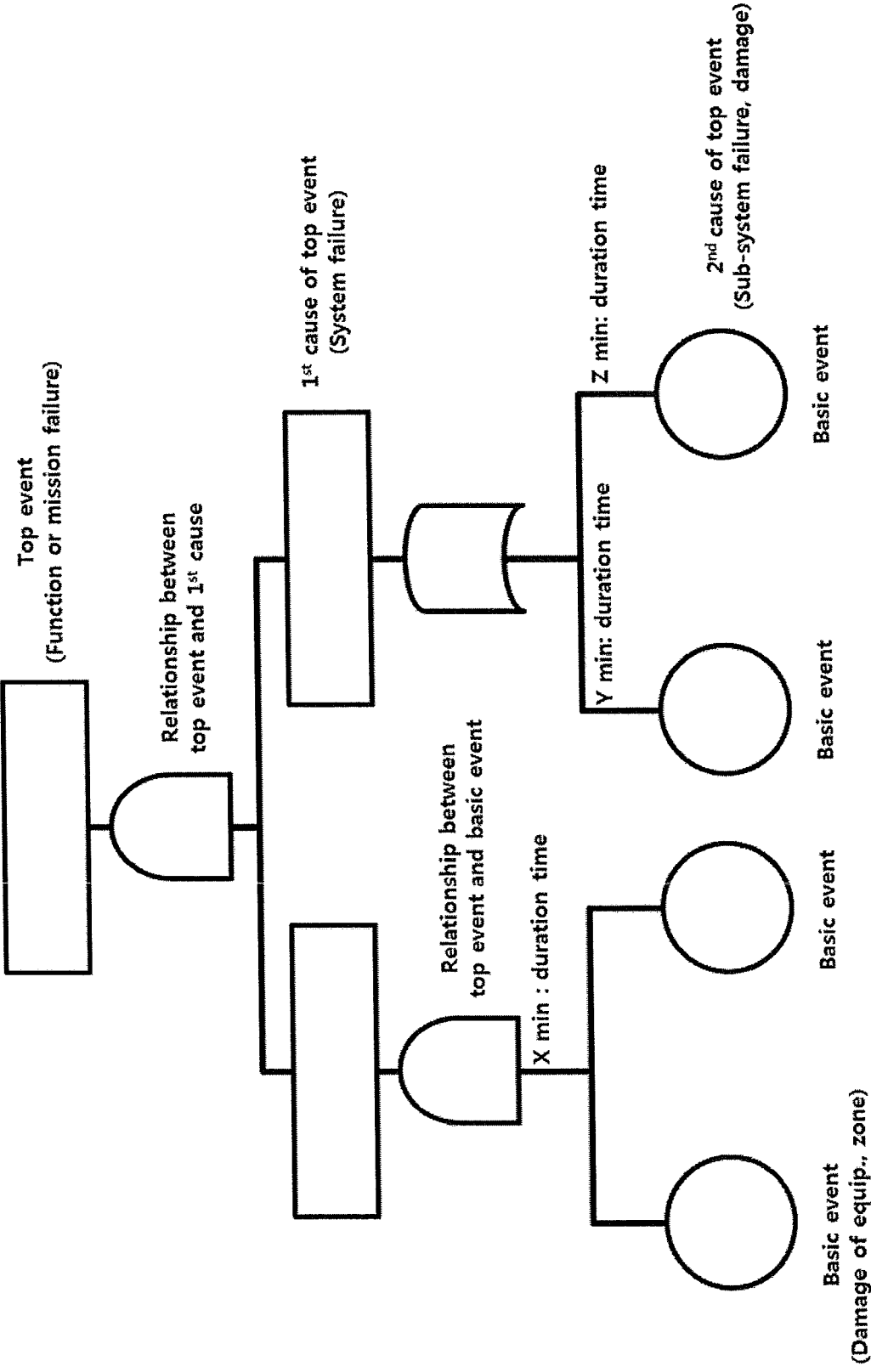
【Fig. 4】



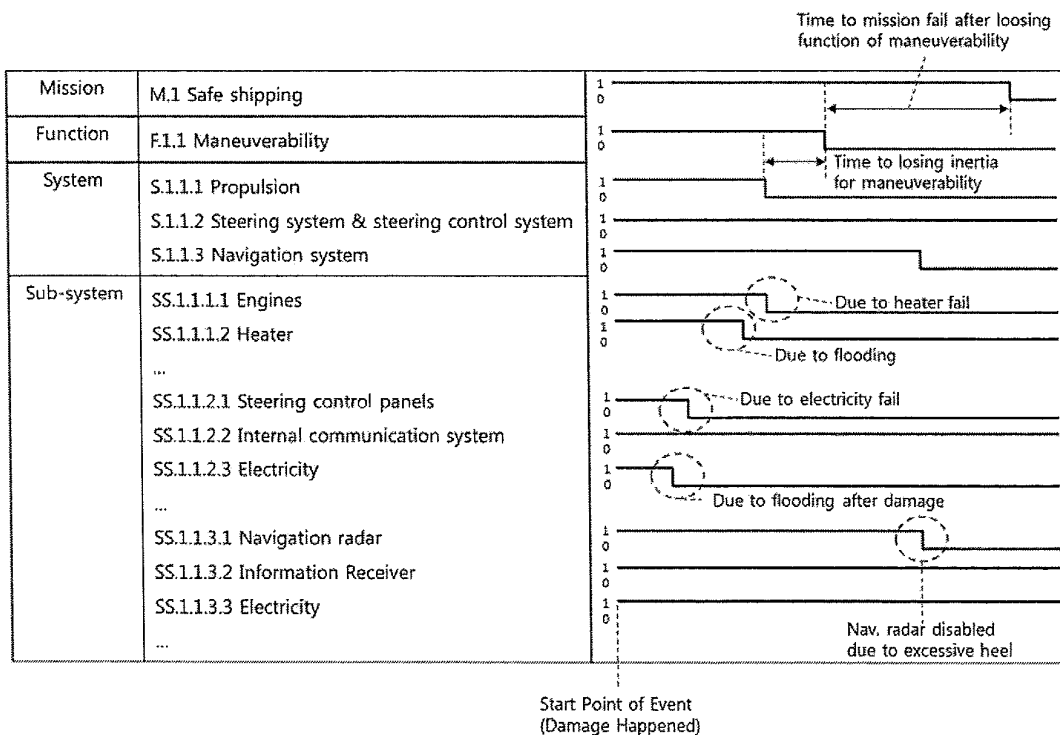
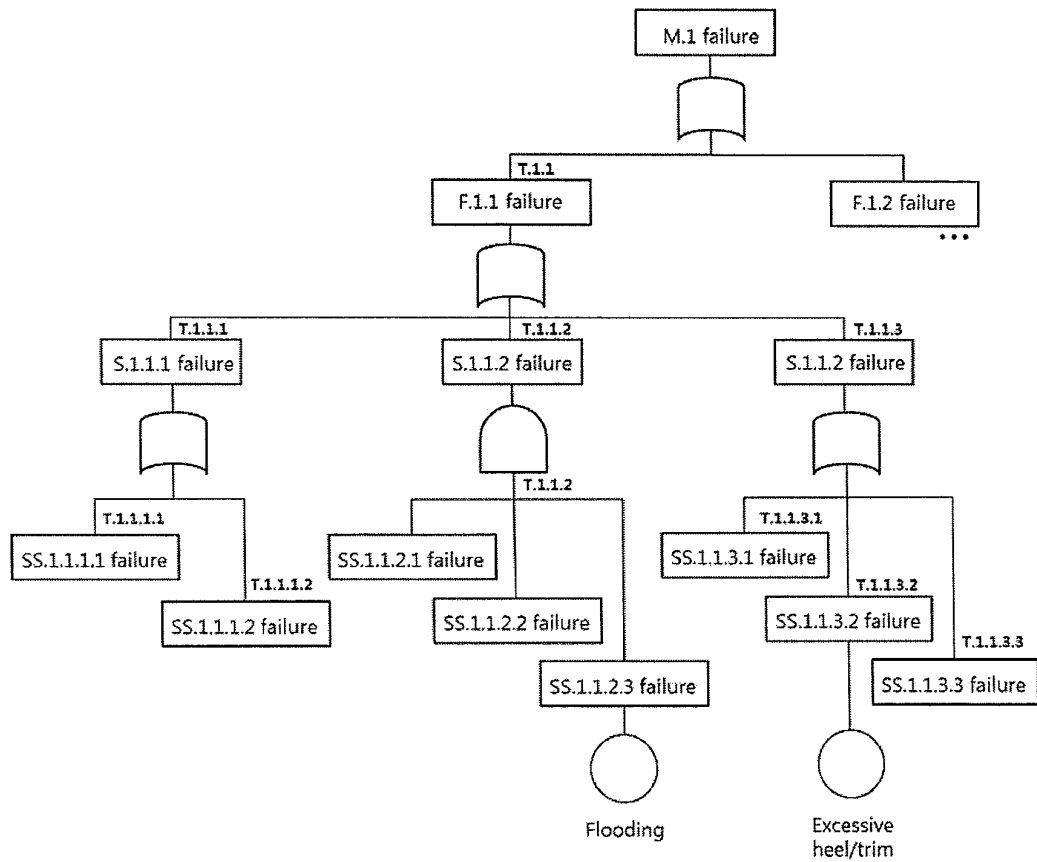


【Fig. 5】

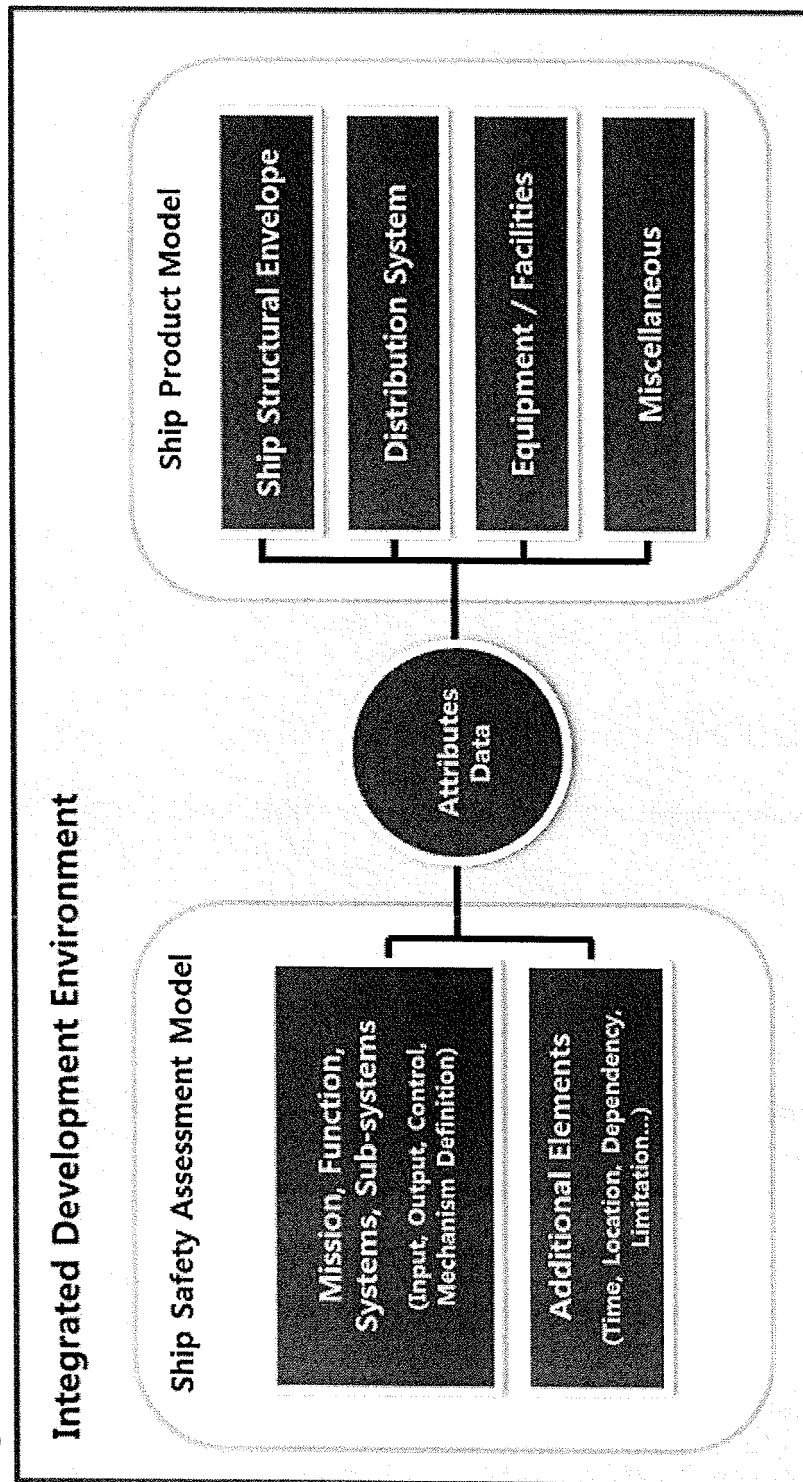
【Fig. 6】



【Fig. 7】



【Fig. 8】

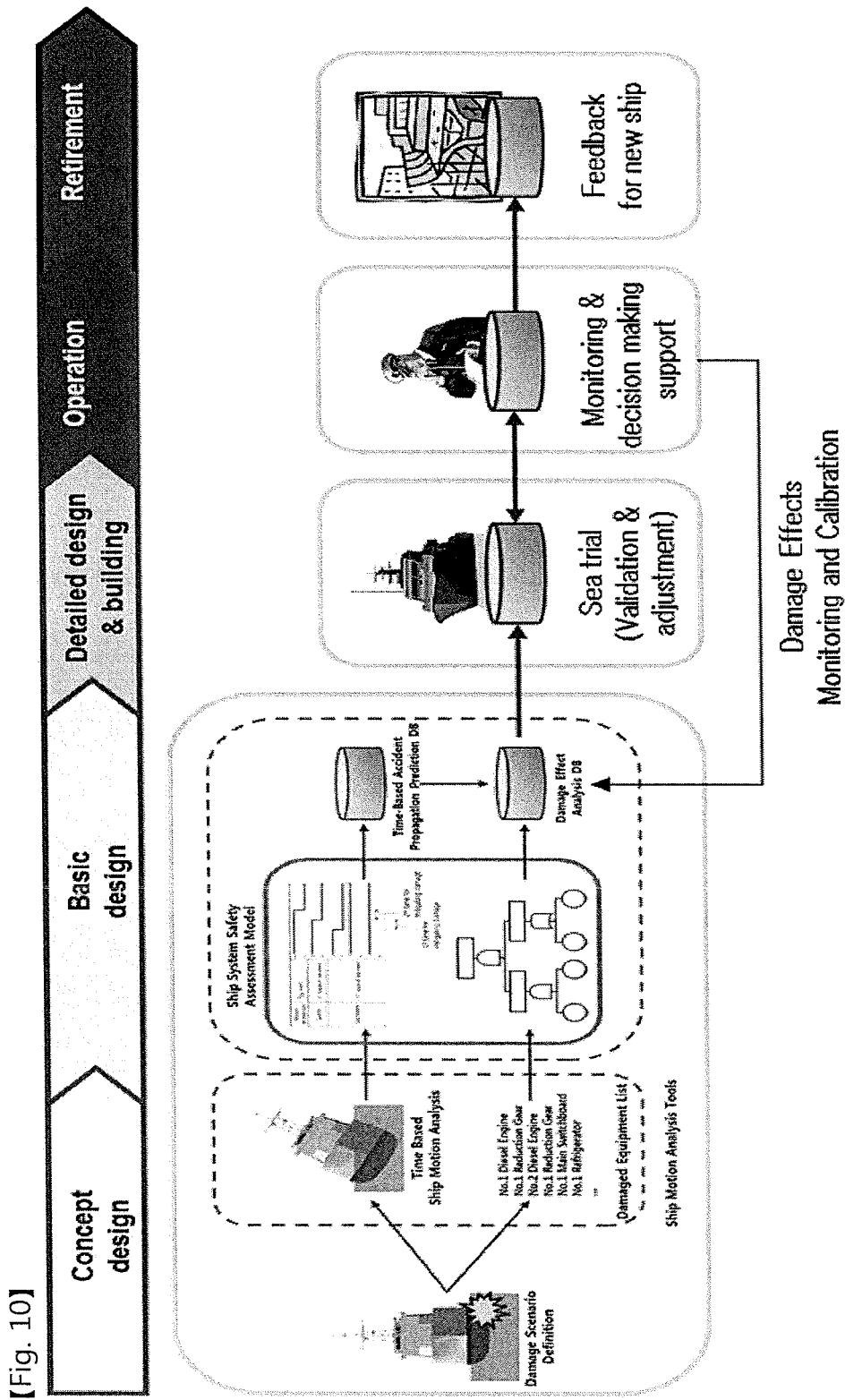


【Fig. 9】

Function	Input	Co-Ind	Output	Mechanism	Dependency to Mission	Derivate from Sys. Failure
F11 Manoeuvrability	G1112 Position	G1112 SLAVE 1, 2 & 3 G1112 Scales G1112 COORDINATES		M1111 DCM* M1112 R* M1113 WADSP*		F1111 DCM, from G1111 failure F1112 DCM, from G1112 failure F1113 WADSP, from G1113 failure
	G1117 Timing system & steering control system	--	M11	--	OR	
	G1118 Navigation system					

System	Input	Control	Output	Mechanism	Dependency to Modules	Duration Time from Sub Sys. Start	Utilization	Location
S1111 Inrush	S1111.1 Engine S1111.2 Brake	C11111 SOLAS 4-1, Reg.8-1 SOLAS 8-2, Reg.21 C11112 45-74-25-A C11112 45-74-25-B C11113 Alarm control system	P11	M11111 Design Team lead M11112 Recovery Survey Team M11113 M-COP	OR	T11111 60 min from S11111 Failure T11112 60 min from S11112 Failure ..	-	S1111 Engine room S1112 Generator room S1113 Steering gear room
S1112 Steering system & steering control system	S1112.1 Steering control panel S1112.2 Internal communication system S1112.3 Intensity ..	C11111 SOLAS 4-1, Reg.8-1 SOLAS 8-2, Reg.21 C11111 ..		M11111 Design Team lead M11112 Recovery Survey Team M11113 M-COP	OR	T11111 60 min from S11112 .. S11112	-	S1111 Engine control room S1112 Steering gear room S1113 Wheel House
S1113 Navigation system	S1113.1 Navigation radar S1113.2 Performance monitor S1113.3 Electricity ..	..		M11111 ..	OR	..	-	S1113 Wheel House

Sub-system	Input	Control	Output	Mechanism	Dependency in Mission	Limitation	Location
SS1.1.1.1 Engine	SS1.1.1.1.1 Fuel Tank SS1.1.1.1.2 Purge SS1.1.1.1.3 Nozzle ...	CC1.1.1.1.1 GDSM D-1 Reg-3-2 CC1.1.1.1.2 ...	SS1.1.1.1	SS1.1.1.1.1 Manager D03 SS1.1.1.1.2 Manager D04 SS1.1.1.1.3 Manager D05	GA	...	SS1.1.1.1.1 Engine room
SS1.1.1.2 Turbo	SS1.1.1.2.1 Fuel Tank SS1.1.1.2.2 Circulation pump SS1.1.1.2.3 Boost pump ...	...	SS1.1.1.2, SS1.1.2, SS1.1.3	...	GA	...	SS1.1.1.2 Turbo room ...
SS1.1.1.3 Stowing control system	...	...	...	...	AVD	...	SS1.1.1.3 Stowing gear room ...
SS1.1.1.4 Internal communication system	...	...	...	...	AVD	...	SS1.1.1.4 Stowing gear room SS1.1.1.4 Stowing gear room
SS1.1.1.5 Stowage	...	...	...	...	...	...	SS1.1.1.5 Stowage room ...
SS1.1.1.6 Navigation table	...	...	...	...	...	...	SS1.1.1.6 Navigation table ...
SS1.1.1.7 Information receiver	...	...	...	...	...	...	SS1.1.1.7 Information receiver ...
SS1.1.1.8 Security	...	...	...	...	...	...	SS1.1.1.8 Security room ...



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2013/002180

A. CLASSIFICATION OF SUBJECT MATTER

G06F 19/00(2011.01)i, G06F 17/50(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: G06F 19/00; E04B 1/00; G06F 17/30; G06F 17/60; B63B 43/18; G08G 3/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility models and applications for Utility models: IPC as above

Japanese Utility models and applications for Utility models: IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS (KIPO internal) & Keywords: ship safety assessment, assessment model, database,

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2003-041649 A (NTT POWER & BUILDING FACILITIES INC) 13 February 2003 Abstract, claims 1 to 3, figures 1 to 2	1
A	JP 3760159 B2 (INOUE KINZO, JAPAN MARINE SCIENCE INC.) 29 March 2006 Claims 1 to 4, figures 1 to 6	1
A	JP 2002-288386 A (NATIONAL MARITIME RESEARCH INSTITUTE) 04 October 2002 Abstract, claim 1, figure 7	1

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

15 APRIL 2013 (15.04.2013)

Date of mailing of the international search report

19 APRIL 2013 (19.04.2013)

Name and mailing address of the ISA/KR


 Korean Intellectual Property Office
 Government Complex-Daejeon, 189 Seonsa-ro, Daejeon 302-701,
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2013/002180

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Patent document cited in search report	Publication date	Patent family member	Publication date
JP 2003-041649 A	13.02.2003	NONE	
JP 3760159 B2	29.03.2006	JP 2004-318380 A	11.11.2004
JP 2002-288386 A	04.10.2002	NONE	