Núcleo de Propriedade Intelectual - NPI

RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

Pesquisa em documentos de patentes e literatura científica

Dados da Solicitação	**Data:**	14/03/2019	**Nº Pedido:**	08/2019
Nome	Marco Reis		**HH**:	3h
E-mail	marcoreis@fieb.org.br		**Telefone:**	071 999 82 62 62
Unidade	Senai Cimatec			
Área/Núcleo	Automação - Robótica			
Nome do Projeto	ManiSub			
Empresa Parceira	Petrobras			
Agência de Fomento	ANP + Embrapii			
Resp. pela busca	Maria do Carmo			

Dados de Subsídio a Busca

Título Provisório	Manipulador Subaquático Autônomo

Descrição detalhada

Faça uma descrição do objeto de pesquisa, especificando as suas diferenças em relação aos atuais ou qual é a inovação do produto, processo ou aplicação foco desta pesquisa.

O projeto refere-se ao desenvolvimento de um manipulador autônomo, ou seja, o mesmo toma as suas próprias decisões. O principal objetivo do projeto é projetar e construir uma prova de conceito para subsidiar a análise de viabilidade técnica-econômica de automatizar operações submarinas com manipuladores em ROV – *Remotely Operated Vehicle* (veículo submarino operado remotamente). Este manipulador que será o tema central terá 6DoF (degree of freedom, em português, graus de liberdade) e terá como base uma plataforma móvel como referência a simulação do ambiente marinho. O projeto ainda abrangerá o detalhamento das operações mais usuais do uso de manipuladores em ROV, estudo do estado da arte dos manipuladores subaquáticos. Além disso o projeto deverá elaborar uma análise de viabilidade técnico-econômica com o objetivo de automatizar algumas operações desempenhadas por manipuladores subaquáticos.

PALAVRAS-CHAVE: Termos técnicos ou científicos e sinônimos em português e inglês *(insira quantas linhas forem necessárias)*

Português	Inglês
Manipulação subaquática	Underwater manipulation
Manipulador subaquático	Underwater manipulator
Manipulador subaquático autônomo	Autonomous underwater manipulator
Braço robótico subaquático	Underwater robot arm
Braço robótico subaquático autônomo	Autonomous underwater robot arm
Robótica submarina	Marine robotics
ROV	ROV
Veículo Operado Remotamente	Remotly Operated Vehicle
Controle de manipuladores subaquático	Underwater manipulator control

Justificativa da Solicitação *(Projeto com empresa? Projeto com órgão de fomento? Pesquisa Aplicada? Desenvolvimento Interno?)*

A utilização de veículos remotamente operado (ROV) compacto para inspeção submarina sempre teve uma vantagem inerente de menores custos de aquisição e operacionais, em parte devido ao seu pequeno tamanho e capacidade de lançamento a partir da instalação de suporte, sem a necessidade de um navio de apoio. A introdução de elementos que favoreçam a automação destes ROVs deve ser analisada do ponto de vista técnico e econômico. O desenvolvimento deste projeto visa analisar os ganhos em termos de redução de exposição de pessoal a riscos referentes a mergulho e também os benefícios econômicos em comparação à prática atual. Logo, ter um panorama da área de pesquisa referente a artigos e patentes desenvolvidos neste ambiente é importante para a elaboração e desenvolvimento do projeto.

Bancos de Dados

Bancos de Dados	INPI – Instituto Nacional de Propriedade Industrial	www.inpi.gov.br
	ESPACENET – European Patent Office	pt.espacenet.com
	USPTO – United States Patent and Trademark Office	www.uspto.gov
	SCIELO – Scientific Eletronic Library on line	www.scielo.com.br

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	Portal de Periódicos da CAPES	www.periodicos.capes.gov.br
	WIPO – Organização Mundial de Propriedade Intelectual	www.wipo.int
	Google patents	www.google.com/patents
	Clarivate Analytics - Derwent Innovation	**www.derwentinnovation.com**
	Outros	
Estratégia da busca	*Busca Simples e Avançada em todas as bases de dados incluindo CIP-Classificação Internacional de Patentes* • Palavras-chave em título (expressão completa) e resumo de documentos de patentes com uso de conectores Booleanos, conforme manual de cada base. • Busca por número de Classificação Internacional de Patentes (CIP)	

Informações Gerais

A busca prévia de anterioridade é uma amostragem e não verifica os documentos de patentes que estão em período de sigilo, que é de 18 meses a partir da data de pedido de depósito nos escritórios oficiais de proteção da propriedade intelectual. Portanto se algum documento similar ou igual estiver no período de sigilo, não estarão disponíveis nos bancos de dados de patentes. Além disso, a busca prévia não garante a abrangência do campo de pesquisa bibliográfica na totalidade da literatura técnica publicada no mundo.

Resultados da Pesquisa de Anterioridade de Tecnologia realizada na *Derwent Innovation*

Conforme dados abaixo, realizamos 4 pesquisas de anterioridade de tecnologias nos bancos de dados referenciados, tendo como ferramenta principal de busca a ***Derwent Innovation.*** Identificamos patentes relacionadas ao objeto da pesquisa solicitado "**Manipulador Subaquático Autônomo**", conforme dados abaixo.

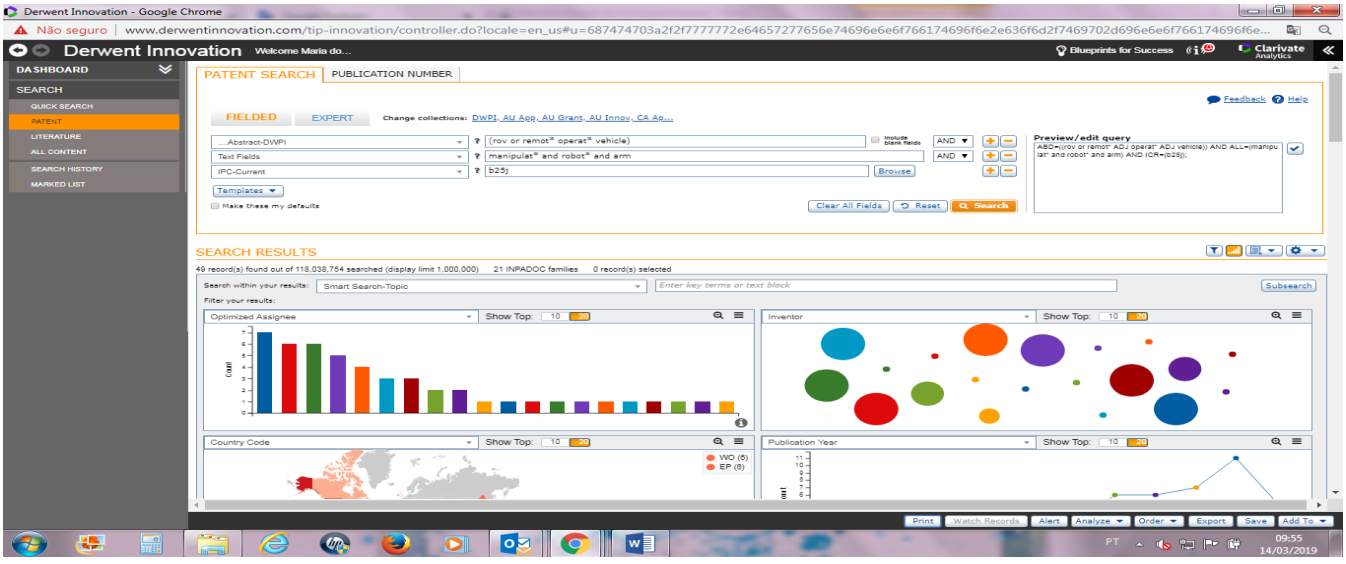
ESTRATÉGIA DE BUSCA

- Banco de dados: *Derwent Innovation* (https://www.derwentinnovation.com/login/)
- Bases de dados: patentes
- Período: 2000 a 2018
- Tema: *(rov or remot* operat* vehicle) and manipulat* and robot* and arm*
- Ipc-corrent: b25j
- Campo: *Abstract* DWPI

Para a pesquisa de anterioridade de tecnologia na base de dados da Patentes, com a estratégia de busca acima, tivemos o resultado com **21 documentos de patentes** que devem ser analisadas pelos pesquisadores da área solicitante.

Resultados da Pesquisa feita pelo NPI *(a ser preenchido pelo NPI)*:

ESTRATÉGIA DE BUSCA NA DERWENT INNOVATION

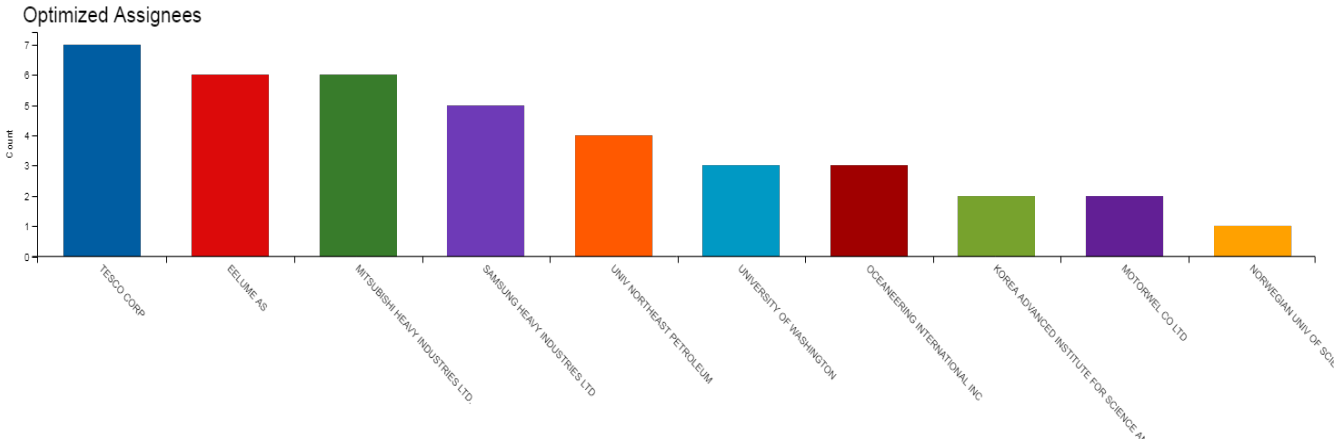


RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

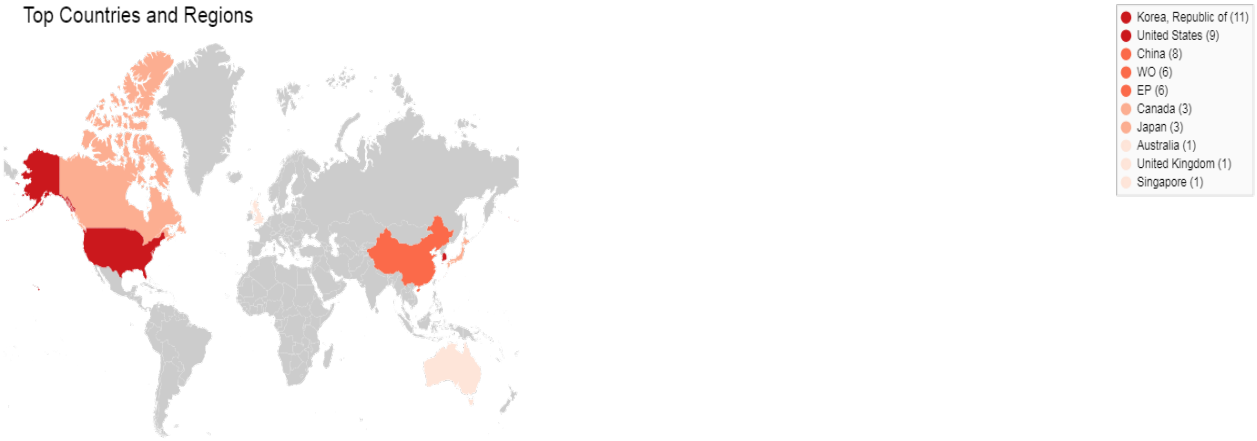
Pesquisa em documentos de patentes e literatura científica

O gráfico abaixo apresenta os principais depositantes de patentes:

1. TESCO CORP: 7 record(s)
2. EELUME AS: 6 record(s)
3. MITSUBISHI HEAVY INDUSTRIES LTD.: 6 record(s)
4. SAMSUNG HEAVY INDUSTRIES LTD: 5 record(s)
5. UNIV NORTHEAST PETROLEUM: 4 record(s)
6. UNIVERSITY OF WASHINGTON: 3 record(s)
7. OCEANEERING INTERNATIONAL INC: 3 record(s)
8. KOREA ADVANCED INSTITUTE FOR SCIENCE AND TECHNOLOGY: 2 record(s)
9. MOTORWEL CO LTD: 2 record(s)
10. NORWEGIAN UNIV OF SCIENCE & TECHNOLOGY (NTNU): 1 record(s)



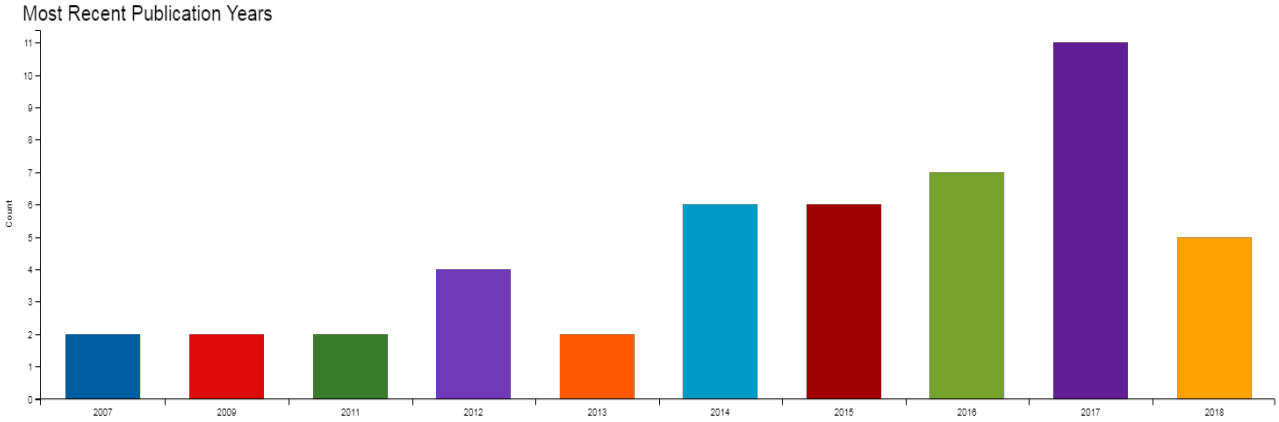
Conforme gráfico abaixo, a Coréia é o país com maior número de patentes (11 registros), em seguida vem os EUA com 9 registros e a China com 3. Os 6 registros de patentes com a sigla WO são de famílias de patentes registradas na Organização Internacional de Propriedade Intelectual (OMPI/WIPO), através do *Patent Cooperation Treaty* (PCT), que permite o depósito de patentes em aproximadamente 145 países durante 30 meses, conhecida como fase internacional. Após os 30 meses, os depositantes devem indicar os países para entrada no pedido de patentes na fase nacional.



RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

Pesquisa em documentos de patentes e literatura científica

Conforme gráfico abaixo, 2017 foi o ano com maior número de patentes registradas pelos principais depositantes (11 registros).



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RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

Pesquisa em documentos de patentes e literatura científica

REFERÊNCIAS DE DOCUMENTOS DE PATENTES

PATENT RESULT SET Thursday, March 14 2019 Derwent Innovation

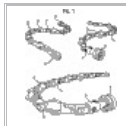
Search results for: ABD=((rov or remot* ADJ operat* ADJ vehicle)) AND ALL=(manipulat* and robot* and arm) AND ICR=(b25j);
Collections searched: DWPI, US Granted, Australian Innovation, Canadian Applications, US Applications, Australian Granted, French Granted, French Applications, European Granted, Australian Applications, German Utility Models, European Applications, British Applications, British Granted, German Granted, WIPO Applications, Canadian Granted, German Applications, Russian Utility Models, Russian Applications, Chinese Utility Models, Indonesian Simple, Korean Utility Models, Singaporean Applications, Chinese Granted, Indonesian Applications, Korean Granted/Examined, Thai Granted/Examined, Chinese Applications, Japanese Utility Models, Korean Applications, Vietnamese Granted, Indian Granted, Japanese Granted, Malaysian Granted, Vietnamese Applications, Indian Applications, Japanese Applications, Singaporean Granted, Other Authorities

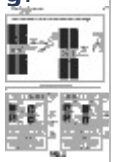
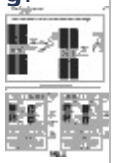
49 record(s) found out of 118,038,754 searched (display limit 1,000,000) 21 INPADOC families 0 record(s) selected

Publication Number	Optimized Assignee	Publication Date	Application Date	Relevancy
JP2018505784A	-	2018-03-01	2016-01-13	39
DWPI Drawing: 	**Title**: 水中マニピュレータアームロボット **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: 複数の関節モジュール２によって互いに連結されている複数のリンクであって、水中マニピュレータアームロボットの曲げ動作を発生させる複数のリンクと、前記水中マニピュレータアームロボットの胴体の複数の異なる部位に配置された複数の駆動デバイス６、８、１８であって、前記水中マニピュレータアームロボットに駆動力を加えて推進および／または誘導させる複数の駆動デバイス６、８、１８と、前記水中マニピュレータアームロボットに取り付けられる少なくとも一つのツール１２、１４、または前記水中マニピュレータアームロボットに取り付けられるツールを連結する少なくとも一つの連結部と、を有し、前記曲げ動作および／または前記複数の駆動デバイスによって、前記水中マニピュレータアームロボットを動かすこと、並びに前記ツールの向きおよび／または位置を調整することが可能になっている水中マニピュレータアームロボット。【選択図】図１			
CA2973295A1	EELUME AS	2016-08-04	2016-01-13	668
DWPI Drawing:	**Title**: UNDERWATER MANIPULATOR ARM ROBOT **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules (2) for generating a flexural motion of the robot; multiple thrust devices (6), (8), (18) located at different points along the length of the robot for applying thrust to			

	the robot for propulsion and/or guidance; and at least one tool (12), (14), or at least one connection point for a tool, attached to the robot; wherein the flexural motion and/or thrust devices (6), (8), (18) enable movement of the robot and control of the orientation and/or location of the tool (12), (14)			
KR20171297070A	EELUME AS	2017-11-27	2016-01-13	593
DWPI Drawing: 	**Title**: OMITTED **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules (2) for generating a flexural motion of the robot; multiple thrust devices (6), (8), (18) located at different points along the length of the robot for applying thrust to the robot for propulsion and/or guidance; and at least one tool (12), (14), or at least one connection point for a tool, attached to the robot; wherein the flexural motion and/or thrust devices (6), (8), (18) enable movement of the robot and control of the orientation and/or location of the tool (12), (14)			
SG11201705624A1	EELUME AS	2017-08-30	2016-01-13	574
DWPI Drawing: 	**Title**: UNDERWATER MANIPULATOR ARM ROBOT **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules (2) for generating a flexural motion of the robot; multiple thrust devices (6), (8), (18) located at different points along the length of the robot for applying thrust to the robot for propulsion and/or guidance; and at least one tool (12), (14), or at least one connection point for a tool, attached to the robot; wherein the flexural motion and/or thrust devices (6), (8), (18) enable movement of the robot and control of the orientation and/or location of the tool (12), (14)			
WO2016120071A1	NORWEGIAN UNIV OF SCIENCE & TECHNOLOGY (NTNU)	2016-08-04	2016-01-13	573
DWPI Drawing:	**Title**: UNDERWATER MANIPULATOR ARM ROBOT **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules (2) for generating			

	a flexural motion of the robot; multiple thrust devices (6), (8), (18) located at different points along the length of the robot for applying thrust to the robot for propulsion and/or guidance; and at least one tool (12), (14), or at least one connection point for a tool, attached to the robot; wherein the flexural motion and/or thrust devices (6), (8), (18) enable movement of the robot and control of the orientation and/or location of the tool (12), (14)			
EP3250345A1	EELUME AS	2017-12-06	2016-01-13	566
DWPI Drawing: 	**Title**: UNDERWATER MANIPULATOR ARM ROBOT **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules (2) for generating a flexural motion of the robot; multiple thrust devices (6), (8), (18) located at different points along the length of the robot for applying thrust to the robot for propulsion and/or guidance; and at least one tool (12), (14), or at least one connection point for a tool, attached to the robot; wherein the flexural motion and/or thrust devices (6), (8), (18) enable movement of the robot and control of the orientation and/or location of the tool (12), (14)			
US20180021945A1	EELUME AS	2018-01-25	2017-07-27	565
DWPI Drawing: 	**Title**: UNDERWATER MANIPULATOR ARM ROBOT **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules for generating a flexural motion of the robot; multiple thrust devices located at different points along the length of the robot for applying thrust to the robot for propulsion and/or guidance; and at least one tool, or at least one connection point for a tool, attached to the robot; wherein the flexural motion and/or thrust devices enable movement of the robot and control of the orientation and/or location of the tool			
AU2016212374A1	EELUME AS	2017-08-03	2016-01-13	563
DWPI Drawing:	**Title**: Underwater manipulator arm robot **DWPI Title**: Underwater manipulator arm robot i.e. ground based snake submersible robot for mapping and monitoring e.g. remotely operated vehicle, has thrust devices located at points for applying thrust to robot, where motion enables movement of robot **Abstract**: An underwater manipulator arm robot comprises: a plurality of links that are connected to one another by joint modules (2) for generating a flexural motion of the robot; multiple thrust devices (6), (8), (18) located at different points along the length of the robot for applying thrust to the robot for propulsion and/or guidance; and at least one tool (12), (14), or at least one connection point for a tool, attached to the robot; wherein			

	the flexural motion and/or thrust devices (6), (8), (18) enable movement of the robot and control of the orientation and/or location of the tool (12), (14)			
KR1381105B1	SAMSUNG HEAVY INDUSTRIES LTD	2014-04-02	2012-04-30	318
DWPI Drawing: 	**Title**: ROBOT CONTROL SYSTEM AND ROBOT CONTROL METHOD USING THE SAME **DWPI Title**: Robot management system for managing remote job robot or remotely operated vehicle used for doing various underwater works, has input module that inputs pilot signal to remote job robot through bus lines connected through tether cable **Abstract**: In the invention is the bus lines and remote location, it is about the robot management system, which together operates the robot and the method for operating with robot uses the same. According to one aspect of the present invention, provided is the remote job robot through the tether cable; the wireless communication module which receives the article 2 distinguished minister of state call from the remote location through the wireless communication network; the input module which the first pilot signal is input as to the robotmanagement system installed at the bus lines connected through the tether cable to the remote job robot (ROV: remotely operated vehicle) the first pilot signal and the cable communication module robot management system included transmits the article 2 distinguished minister of state call			
KR20131223 92A	SAMSUNG HEAVY INDUSTRIES LTD	2013-11-07	2012-04-30	325
DWPI Drawing: 	**Title**: ROBOT CONTROL SYSTEM AND ROBOT CONTROL METHOD USING SAME **DWPI Title**: Robot management system for managing remote job robot or remotely operated vehicle used for doing various underwater works, has input module that inputs pilot signal to remote job robot through bus lines connected through tether cable **Abstract**: The present invention relates to a robot control system which controls a robot in a mother ship and a remote place and a robot control method using the same. According to the embodiment of the present invention, the robot control system using the robot which is installed on the mother ship connected to a remote operated vehicle robot via a tether cable and which includes an input module receiving an input of first control signals; a wireless communication module which receives second control signals via a wireless communication network from a remote place; and a cable communication module which receives the first and second control signals from the remote operated vehicle robot via the tether cable can be provided 			
US20170106537A1	UNIVERSITY OF WASHINGTON	2017-04-20	2016-09-02	322
DWPI Drawing:	**Title**: Haptic Virtual Fixture Tools **DWPI Title**: Processing method for defining and utilizing virtual fixtures for haptic navigation within e.g. underwater environment involves utilizing corresponding virtual fixture that provides haptic feedback based on position of virtual robotic tool **Abstract**: Apparatus and methods for defining and utilizing virtual fixtures for haptic navigation within real-world environments, including underwater environments, are provided. A computing device can determine a real-world object within a real-world environment. The computing device can receive an indication of the real-world object. The computing device can determine a virtual fixture that corresponds to the real-world object based on the indication, where aspects of the virtual fixture are configured to align with aspects of the real-world object. The computing device			

	can provide a virtual environment for manipulating the robotic tool to operate on the real-world object utilizing the virtual fixture. The virtual fixture is configured to provide haptic feedback based on a position of a virtual robotic tool in the virtual environment that corresponds to the robotic tool in the real-world environment			
WO2015134391A1	UNIVERSITY OF WASHINGTON	2015-09-11	2015-03-02	318
DWPI Drawing: 	**Title**: HAPTIC VIRTUAL FIXTURE TOOLS **DWPI Title**: Processing method for defining and utilizing virtual fixtures for haptic navigation within e.g. underwater environment involves utilizing corresponding virtual fixture that provides haptic feedback based on position of virtual robotic tool **Abstract**: Apparatus and methods for defining and utilizing virtual fixtures for haptic navigation within real-world environments, including underwater environments, are provided. A computing device can determine a real-world object within a real-world environment. The computing device can receive an indication of the real-world object. The computing device can determine a virtual fixture that corresponds to the real-world object based on the indication, where aspects of the virtual fixture are configured to align with aspects of the real-world object. The computing device can provide a virtual environment for manipulating the robotic tool to operate on the real-world object utilizing the virtual fixture. The virtual fixture is configured to provide haptic feedback based on a position of a virtual robotic tool in the virtual environment that corresponds to the robotic tool in the real-world environment			
EP3114677A1	UNIVERSITY OF WASHINGTON	2017-01-11	2015-03-02	318
DWPI Drawing: 	**Title**: HAPTIC VIRTUAL FIXTURE TOOLS **DWPI Title**: Processing method for defining and utilizing virtual fixtures for haptic navigation within e.g. underwater environment involves utilizing corresponding virtual fixture that provides haptic feedback based on position of virtual robotic tool **Abstract**: Apparatus and methods for defining and utilizing virtual fixtures for haptic navigation within real-world environments, including underwater environments, are provided. A computing device can determine a real-world object within a real-world environment. The computing device can receive an indication of the real-world object. The computing device can determine a virtual fixture that corresponds to the real-world object based on the indication, where aspects of the virtual fixture are configured to align with aspects of the real-world object. The computing device can provide a virtual environment for manipulating the robotic tool to operate on the real-world object utilizing the virtual fixture. The virtual fixture is configured to provide haptic feedback based on a position of a virtual robotic tool in the virtual environment that corresponds to the robotic tool in the real-world environment			
JP2007098567A	HITACHI LTD	2007-04-19	2006-09-25	312
DWPI Drawing:	**Title**: AUTONOMOUS CONTROL TYPE ROBOT AND ITS CONTROL DEVICE **DWPI Title**: Autonomous control type robot e.g. pet robot has independent system for safe monitoring of operation of robot **Abstract**:			

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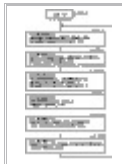
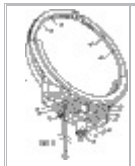
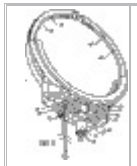
	PROBLEM TO BE SOLVED: To provide an autonomous control type robot capable of making an emergency responding control SOLUTION: The autonomous control type robot is structured as capable of making the emergency responding control by monitoring the safety of the robot operation through an independent system provided separately from the autonomous control system COPYRIGHT: (C)2007, JPO&INPIT COPYRIGHT: (C)2006, JPO&NCIPI			
CN108313241A	UNIV NORTHWESTERN POLYTECHNICAL	2018-07-24	2018-03-16	198
DWPI Drawing: 	**Title**: Electromagnetic adsorption underwater working robot based on ROV platform **DWPI Title**: ROV-based platform electromagnetic absorption mechanical arm robot, has left floating plate fixed with right floating plate, and image module fixed with acrylic plate cabin that is provided with mechanical arm **Abstract**: The invention claims a ROV-based platform of electromagnetic absorption mechanical arm robot, relating to the field of underwater robot, the invention is based on electromagnetic absorption mechanical armrobot ROV, robot platform through four electromagnetic absorption mechanical arm in underwater walking by image module of image and operator cabin real time feedback to two mechanical arm for realizing remote operation, underwater operation. The invention has small volume, single person can carry, convenient working and four thrusters to realize omnidirectional autonomous movement in the water, the front work machine are two changeable arms to realize the fast moving in the water, stable working capacity. performing cruising is far away the ship through absorption, prolong the working time and improves the energy utilization rate, because it has the electromagnetic absorbing ability in complex water area to execute the task, can be widely applied to pipeline detection and maintenance, boat maintenance underwater operation			
CA2722073C	TESCO CORP	2016-02-09	2009-04-27	185
DWPI Drawing: 	**Title**: REMOTELY-OPERATED ROPE-THREADING TOOL **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket **Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye.			
WO2009132432A1	TESCO CORP	2009-11-05	2009-04-27	160
DWPI Drawing:	**Title**: REMOTELY-OPERATED ROPE-THREADING TOOL **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket			

RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

Pesquisa em documentos de patentes e literatura científica

	**Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye			
EP2280893A1	TESCO CORP	2011-02-09	2009-04-27	160
DWPI Drawing: 	**Title**: REMOTELY-OPERATED ROPE-THREADING TOOL **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket **Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye			
CA2722073A1	TESCO CORP	2009-11-05	2009-04-27	160
DWPI Drawing: 	**Title**: REMOTELY-OPERATED ROPE-THREADING TOOL **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket **Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye.			
US20110042979A1	TESCO CORP	2011-02-24	2010-10-27	159
DWPI Drawing:	**Title**: REMOTELY-OPERATED ROPE-THREADING TOOL **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket **Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end			

	of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye			
EP2280893B1	TESCO CORP	2012-06-20	2009-04-27	157
DWPI Drawing: 	**Title**: REMOTELY-OPERATED ROPE-THREADING TOOL **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket **Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye			
US8118340B2	TESCO CORP	2012-02-21	2010-10-27	157
DWPI Drawing: 	**Title**: Remotely-operated rope-threading tool **DWPI Title**: Remotely-operated tool for threading flexible element e.g. rope through threaded socket of e.g. pole, has arms extended and retracted into guiding channels to pull end of flexible object away from arms and drawn through socket **Abstract**: A tool for threading a rope through a distant eye or around an object out of reach, such as for elevating tarps into trees, or placing fall protection lines, or securing a distant object. The tool has two curved arms that extend out from the body in unison and converge at a point where the end of the rope is passed from one arm to the other. The arms are then retracted back into the body, pulling the rope through the eye or around the object. The arms are extended by pulling one control line and retracted by pulling a second control line. The tool is typically mounted on the end of a pole, although other mountings are possible. The shape of the tool enables ropes to be threaded through a large number of eye configurations and around objects of varying sizes, even if there are obstructions adjacent the eye			
KR20151455 90A	KOREA INSTITUTE OF OCEAN SCIENCE & TECHNOLOGY	2015-12-30	2014-06-20	167
DWPI Drawing: 	**Title**: REMOTELY OPERATED VEHICLE SYSTEM FOR UNDERWATER WORK AND THE CONTROL METHOD THEREOF **DWPI Title**: Remote control robot system for underwater work, has a multimedia part that is provided with contact signal processing unit, which senses position of surrounding obstacle of remotely operated vehicle, where signaling information is provided **Abstract**: The present invention relates to a remotely operated vehicle (ROV) system and a control method thereof capable of increasing an efficiency of operation of a user and expanding the efficiency of operation and scope of an ROV by reducing the costs of the ROV system and the costs of a command ship through downsizing of the hardware. The ROV system for underwater work comprises a multimedia part. The multimedia part comprises: an image processing part to provide a front view image using a high definition camera, a work area image using a fixed-focus			

	camera, and a peripheral image of the ROV using a surround camera; a sound processing part having a stereophonic sound sensor part with a plurality of sound sensors mounted on an outer surface of the ROV to measure a direction and magnitude of a sound source and a stereophonic sound system part to generate a stereophonic sound with a direction and magnitude of a virtual sound source corresponding to a sensing signal of the stereophonic sound sensor part; and a contact signal processing part detecting the locations of the obstacles around the ROV to provide contact information step-by-step. As such, the present invention provides a convenience of use, and drastically reduces operational and management costs of the ROVsystem by distribute-processing the signal such as an image, sound, and contact signals required to control the ROV for underwater work in the vehicle and the command ship COPYRIGHT KIPO 2016 REPRESENTATIVE DRAWING - Reference numerals: (100) Multimedia part; (200) Power duplication part; (300) Distribution control part; (400) Manipulator-ROV hull cooperation control part; (500) Communication part			
CN106514660B	UNIV NORTHEAST PETROLEUM	2018-09-04	2016-11-03	156
DWPI Drawing: 	**Title**: A submarine pipeline for detecting underwater robot **DWPI Title**: Submarine pipeline detecting underwater robot, has pipeline main body provided with ROV main body, hydraulic oil tank connected with left side of carrier frame, and clamping line wheels connected with detection device through spring **Abstract**: A submarine pipeline for detecting underwater robot. mainly for solving the problem that the traditional cable underwater robot (ROV) complicated environment influence of ocean current and sea. Wherein, the device comprises an ROV main body, pipe clamping walking device and detecting device. ROV main body as carrier is the conduit gripping device and walking device supplies power to the ROV main body mainly comprises a carrier frame, a mechanical arm, a vertical propeller and horizontal propeller, a buoyancy module, pressure tank, a tripod head, a hydraulic oil tank; the pipe clamping walking device is mainly used for clamping the pipeline to ensure that concave wheel tightly pipeline for walking, conduit gripping device can adjust size to adapt to pipelines with different diameters; the detecting device through various sensors and multiple detecting devices to support the ship is working platform to finish the whole surface of the submarine pipeline detecting. the invention can reduce the ocean current affects the stability of the measurement and traditional ROV thruster operation when damage to the surrounding environment			
CN106514660A	UNIV NORTHEAST PETROLEUM	2017-03-22	2016-11-03	150
DWPI Drawing: 	**Title**: Remote operated vehicle for subsea pipeline detection **DWPI Title**: Submarine pipeline detecting underwater robot, has pipeline main body provided with ROV main body, hydraulic oil tank connected with left side of carrier frame, and clamping line wheels connected with detection device through spring **Abstract**: A submarine pipeline for detecting underwater robot. mainly for solving the problem that the traditional cable underwater robot (ROV) susceptible to ocean, complex submarine environment problem. wherein the device comprises an ROV main body, pipe clamping walking device and detection device. ROV main body as a carrier tube gripping device and walking device provides power to the ROV main body mainly comprises a carrier frame, a mechanical arm, a vertical propeller and horizontal propeller, buoyancy module, pressure tank, a tripod head, a hydraulic oil tank; a pipeline clamping walking device is mainly used for clamping the pipeline to ensure that concave wheel close to the pipeline to walk, conduit gripping device size can be adjusted to adapt to different diameters of the pipe; the detecting device through various sensors and various detection device, to support the ship is working platform to finish the whole face detection to the subsea pipeline. the invention can reduce the influence and traditional ROV propeller operation the measurement stability of ocean, damage to the surrounding environment and so on			
GB2447800A	ALLAN ELSIE A	2008-09-24	2008-05-14	153

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RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

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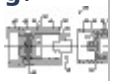
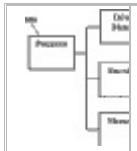
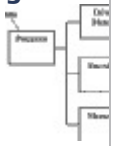
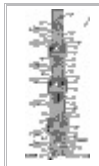
DWPI Drawing: 	**Title**: Tool interface and method **DWPI Title**: Robotic tool interface for use in e.g. manufacturing environments, has first and second connecting assemblies adapted to allow transmission of hydraulic fluid, electrical power, data or control signal between robotic apparatus and tool **Abstract**: The present invention relates to a interface (100) for connecting a tool to a robotic apparatus. In an embodiment, the interface includes a first assembly (102) attached to the robotic apparatus and a second assembly (104) attached to the tool, and the first and second assemblies can be coupled to one another. The interface can allow transmission between the robotic apparatus and the tool of hydraulic fluid, electrical power, data or a control signal			
WO2007045914A2	ROCKSTAR BIDCO LP	2007-04-26	2006-10-23	153
DWPI Drawing: 	**Title**: TOOL INTERFACE AND METHOD **DWPI Title**: Robotic tool interface for use in e.g. manufacturing environments, has first and second connecting assemblies adapted to allow transmission of hydraulic fluid, electrical power, data or control signal between robotic apparatus and tool **Abstract**: The present invention relates to a interface for connecting a tool to a robotic apparatus . In an embodiment, the interface includes a first assembly attached to the robotic apparatus and a second assembly attached to the tool, and the first and second assemblies can be coupled to one another. The interface can allow transmission between the robotic apparatus and the tool of hydraulic fluid, electrical power, data or a control signal			
US8760100B2	OCEANEERING INTERNATIONAL INC	2014-06-24	2011-10-12	138
DWPI Drawing: 	**Title**: Electric manipulator joint **DWPI Title**: Electric manipulator joint for use with manipulator arm in e.g. remotely operated vehicle utilized in bomb disposal, has torque limiter fixedly coupled to housing and releasably coupled to drive shaft **Abstract**: A manipulator joint includes an encoder having a body and shaft. The encoder body may be fixed to a first housing and the encoder shaft may be fixed to a second housing. The second housing is separate from, distal to, and rotatable with respect to the first housing. Rotation of the second housing may be about a common axis shared with the first housing. A hollow driveshaft, rotatably coupled to the second housing, extends across the joint from the second to the first housing. A torque limiter may be fixedly coupled to the second housing and releasably coupled to the driveshaft. The encoder may be configured to output an absolute angular position of the first housing with respect to the second housing. A method of detecting an over-torque condition of the manipulator joint includes transmitting commands from a processor to the drive motor and receiving data from the encoder			
US20120089254A1	OCEANEERING INTERNATIONAL INC	2012-04-12	2011-10-12	147
DWPI Drawing:	**Title**: Electric Manipulator Joint **DWPI Title**: Electric manipulator joint for use with manipulator arm in e.g. remotely operated vehicle utilized in bomb disposal, has torque limiter fixedly coupled to housing and releasably coupled to drive shaft **Abstract**: A manipulator joint includes an encoder having a body and shaft. The encoder body may be fixed to a first housing and the encoder shaft may be fixed to a second housing. The second housing is separate from, distal to, and rotatable with respect to the first housing. Rotation of the second housing may be about a common axis shared with the first housing. A hollow driveshaft, rotatably coupled to the second housing, extends across the joint from the second to the first housing. A torque limiter may be fixedly coupled to the second housing and releasably coupled to the			

	driveshaft. The encoder may be configured to output an absolute angular position of the first housing with respect to the second housing. A method of detecting an over-torque condition of the manipulator joint includes transmitting commands from a processor to the drive motor and receiving data from the encoder			
WO2012051345A1	OCEANEERING INTERNATIONAL INC	2012-04-19	2011-10-12	144
DWPI Drawing: 	**Title**: ELECTRIC MANIPULATOR JOINT **DWPI Title**: Electric manipulator joint for use with manipulator arm in e.g. remotely operated vehicle utilized in bomb disposal, has torque limiter fixedly coupled to housing and releasably coupled to drive shaft **Abstract**: A manipulator joint includes an encoder having an encoder body and encoder shaft. The encoder body may be fixed to a first housing and the encoder shaft may be fixed to a second. The second housing is separate from, distal to, and rotatable with respect to the first housing. Rotation of the second housing may be about a common axis shared with the first housing. A driveshaft may be rotatably coupled to the second housing and extend across the joint from the second to the first housing. A torque limiter may be fixedly coupled to the first housing and releasably coupled to the driveshaft. The encoder may be configured to output an absolute angular position of the first housing with respect to the second housing. A method of detecting an over- torque condition of the manipulator joint includes transmitting commands from a processor to the drive motor and receiving data from the encoder			
CN204414112U	WUHAN MARINE MACHINERY PLANT CO LTD	2015-06-24	2014-12-23	143
DWPI Drawing: 	**Title**: Underwater manipulator **DWPI Title**: Underwater machine hand, has section machine arm framework mounted at machine arm mounting base, operation part mounted at end part of energy-saving machine arm framework, and rotary seat located on tool mounting base **Abstract**: The utility model claims a cable control for small unmanned underwater robot (ROV) of professional underwater mechanical hand, specifically an electric operation tool for underwater cutting, underwater drilling and water under changeable working tool for mounting on the ROV. This multifunctional underwater mechanical arm comprises a mechanical arm mounting seat, at least one mechanical arm frame, a linear driving mechanism is hinged, and the operation part, the operation part comprises a revolving base, a revolving motor for driving the revolving rotary. mounting the revolving working tool driving work tool rotary working rotary motor, revolving motor through tool mounting base is fixed at the tail end of one section of the mechanical armframework, fixed seat by a fastener to the tool mounting base, revolving motor, rotary seat are respectively located at the two sides of the tool mounting base. The utility model has simple structure, multiple functions and low maintenance cost			
US9701029B2	MITSUBISHI HEAVY INDUSTRIES LTD.	2017-07-11	2016-04-29	131
DWPI Drawing:	**Title**: Manipulator **DWPI Title**: Hydraulic manipulator for use in deep sea, has arm provided with joint parts and link parts, bellows container formed with interior spaces, and multiple servo amplifiers connected with manipulator body by cables **Abstract**: A manipulator includes an arm, a plurality of servo motors, a plurality of servo amplifiers, and at least one bellows container. The arm includes a plurality of joints and links. The plurality of the servo motors are disposed in a first space in the arm and capable of driving each			

	of the plurality of the joints. The plurality of the servo amplifiers are disposed in the first space and each of the plurality of the servo amplifiers controls each of the plurality of the servo motors. The at least one bellows container with one closed end which is positioned away from the arm and another open end includes a second space which is connected to the first space at the open end. In the manipulator, each of the first space and the second space is filled with oil, and each of the plurality of the servo amplifiers is connected with a cable for serial communication or power-line carrier communication			
EP3067168A1	MITSUBISHI HEAVY INDUSTRIES LTD.	2016-09-14	2014-07-28	126
DWPI Drawing: 	**Title**: MANIPULATOR **DWPI Title**: Hydraulic manipulator for use in deep sea, has arm provided with joint parts and link parts, bellows container formed with interior spaces, and multiple servo amplifiers connected with manipulator body by cables **Abstract**: A manipulator (1) includes an arm (4), a plurality of servo motors (32), a plurality of servo amplifiers (33), and a bellows container (14). The arm (4) includes a plurality of joints (3) and links (2). The plurality of servo motors (32) is disposed in a first space (6) in the arm (4) and capable of driving each of the joints (3). The plurality of servo amplifiers (33) is disposed in the first space (6) and controls each of the servo motors (32). The bellows container (14) includes a second space (13) which is connected to the first space (6). In the manipulator(1), each of the first space (6) and the second space (13) is filled with oil, and the plurality of servo amplifiers (32) are connected with a cable for serial communication or power-line carrier communication			
JP2015093329A	MITSUBISHI HEAVY INDUSTRIES LTD.	2015-05-18	2013-11-08	126
DWPI Drawing: 	**Title**: MANIPULATOR **DWPI Title**: Hydraulic manipulator for use in deep sea, has arm provided with joint parts and link parts, bellows container formed with interior spaces, and multiple servo amplifiers connected with manipulator body by cables **Abstract**: PROBLEM TO BE SOLVED: To provide an electrically-driven manipulator capable of suppressing ununiformity of pressure when a cable is immersed SOLUTION: A manipulator includes: an arm having a plurality of joint sections and link sections; a plurality of servo motors which are disposed in a first space in the arm and are capable of driving each of the plurality of joint sections; a plurality of servo amplifiers which are disposed in the first space so as to control each of the plurality of servo motors; and a bellows container having a second container connected to the first space. Each of the first space and the second space is filled with oil. The plurality of servo amplifiers are connected by serial communication or power line carrier communication cables			
US20160271807A1	MITSUBISHI HEAVY INDUSTRIES LTD.	2016-09-22	2016-04-29	123
DWPI Drawing:	**Title**: MANIPULATOR **DWPI Title**: Hydraulic manipulator for use in deep sea, has arm provided with joint parts and link parts, bellows container formed with interior spaces, and multiple servo amplifiers connected with manipulator body by cables			

RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

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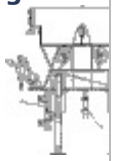
	**Abstract**: A manipulator includes an arm, a plurality of servo motors, a plurality of servo amplifiers, and a bellows container. The arm includes a plurality of joints and links. The plurality of servo motors is disposed in a first space in the arm and capable of driving each of the joints. The plurality of servo amplifiers is disposed in the first space and controls each of the servo motors. The bellows container includes a second space which is connected to the first space. In the manipulator, each of the first space and the second space is filled with oil, and the plurality of servo amplifiers are connected with a cable for serial communication or power-line carrier communication			
WO2015068436A1	MITSUBISHI HEAVY INDUSTRIES LTD.	2015-05-14	2014-07-28	120
DWPI Drawing: 	**Title**: MANIPULATOR **DWPI Title**: Hydraulic manipulator for use in deep sea, has arm provided with joint parts and link parts, bellows container formed with interior spaces, and multiple servo amplifiers connected with manipulator body by cables **Abstract**: This manipulator (1) is equipped with: an arm (4) that has multiple joint sections (3) and link sections (2); multiple servomotors (32) that are disposed inside an internal first space (6) of the arm (4) and are capable of respectively driving the multiple joint sections (3); multiple servo amplifiers (33) that are disposed inside the first space (6) and respectively control the multiple servomotors (32); and a bellows container (14) that has a second space (13) connected to the first space (6). The first space (6) and the second space (13) are respectively filled with oil, and the multiple servomotors (32) are connected using cables for serial communication or power-line carrier communication			
EP3067168A4	MITSUBISHI HEAVY INDUSTRIES LTD.	2016-11-02	2014-07-28	26
DWPI Drawing: 	**Title**: MANIPULATOR **DWPI Title**: Hydraulic manipulator for use in deep sea, has arm provided with joint parts and link parts, bellows container formed with interior spaces, and multiple servo amplifiers connected with manipulator body by cables **Abstract**: -			
CN106270802A	UNIV NORTHEAST PETROLEUM	2017-01-04	2016-11-03	112
DWPI Drawing: 	**Title**: Underwater robot for submarine pipeline cutting **DWPI Title**: Submarine pipeline cutting underwater robot, has hydraulic rod connected with telescopic hydraulic cylinder, small auxiliary manipulator connected with ROV by bolt, and two cutting mechanisms that are overlapped with each other **Abstract**: A submarine pipeline for cutting underwater robot. It is mainly used for cutting processing of petroleum pipeline submarine seriously damaged. by work ROV main body, a cutting mechanism, a support leg and a small auxiliary mechanical arm; the ROV main body comprises a frame, a floating block, a propeller and a seven-degree-of-freedom robot with five degrees of freedom mechanical hand, underwater lighting device, Image pick-up device and a hydraulic electric control device; the supporting legs are uniformly distributed on the two sides of the submarine pipeline cutting robot, its central line and the central line of two sets of cutting mechanism plays a role of supporting the work ROV, small auxiliary mechanical arm through bolt connect at cutting a submarine pipeline robot; on the two sets of cutting mechanisms; the two sets of cutting			

	mechanism through bolt fixed square before and after cutting a submarine pipeline robot bottom and the hydraulic cylinder for orientation with pipeline locating the cutting mechanism to finish the cutting of damaged pipeline by controlling rotation of the knife mechanism. The device can implement mechanical automatic operation in relatively deep waters or special environment			
KR1346278B1	SAMSUNG HEAVY INDUSTRIES LTD	2014-01-03	2012-08-10	93
DWPI Drawing: 	**Title**: REMOTELY OPERATED SUBMARINE VEHICLE SYSTEM **DWPI Title**: Remotely operated vehicle system for performing location survey of coast, comprises absorbing body, robot arm, water jet injection nozzle area and ejector, which are interconnected in sea water pipe using multiple valves **Abstract**: Disclosed is a remotely operated submarine vehicle system. The submarine vehicle system comprises: an absorption unit capable of flowing seawater in; a robotic arm capable of flowing seawater in or shooting out the seawater flowed in; a water-jet spraying nozzle and an ejector for discharging the seawater flowed in; and a controller unit for controlling the influx and discharge of the seawater in order to conduct one of the operations among propulsion, absorption or spray COPYRIGHT KIPO 2014			
CN108945927A	AUTOSTORE TECHNOLOGY AS	2018-12-07	2015-06-16	74
DWPI Drawing: 	**Title**: the remote operation vehicle, tank storage system and related method **DWPI Title**: Remotely operated vehicle assembly for picking up storage bins from storage system, has displacement motor that is configured to generate power which is converted to vertically directed pressure force acting on vehicle rolling units **Abstract**: The invention claims a remote operation vehicle, tank storage system and related method. a remote operation vehicle comprises a vehicle body, a display cavity adapted to receive the storage box in the storage system, a vehicle lifting device, at least indirectly connected to the vehicle body and adapted to lift the storage box into the cavity; a displacement device, especially comprises a displacement motor located above the cavity, configured to at least provide for necessary power to make one or both of the first set of vehicle rolling devices and the second group of vehicles rolling device in displacement between the displacement state and the non-moving state, wherein, in the displacement state. relative vehicle rolling device during use away from the lower layer storage system displacement, in the non-moving state, the associated vehicle rolling device contact during use with the storage system of the lower layer, and a drive device coupled to the displacement device			
KR1422699B1	SAMSUNG HEAVY INDUSTRIES LTD	2014-07-24	2012-09-06	49
DWPI Drawing: 	**Title**: UNDERWATER STATION AND UNDERWATER VEHICLE UNDERWATER VEHICLE MANAGEMENT SYSTEM **DWPI Title**: System for operating underwater moving object e.g. remotely operated vehicle, has upper frame that is connected to bus lines through cable, to serve as support for cage installed in lower portion of upper frame **Abstract**: The present invention relates to the underwater station and underwater moving object operating system, and more specifically, it relates to the station, and the underwater moving object operating system including the same among the number using multiple underwater moving objects. According to one aspect of the present invention, the station among the underwater moving object number of the plurality performing the underwater work; the station among the number launching with the underwater from bus lines it oscillates among the number from the station it includes the underwater moving object operating system which includes can be provided the multiple cages, providing the space in which it is installed in the lower part of the upper frame and the upper frame connected to the bus lines and cable and multiple underwater moving objects are received			

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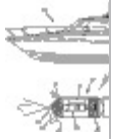
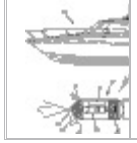
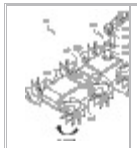
KR20140322250A	SAMSUNG HEAVY INDUSTRIES LTD	2014-03-14	2012-09-06	49
DWPI Drawing: 	**Title**: UNDERWATER STATION AND UNDERWATER VEHICLE OPERATION SYSTEM **DWPI Title**: System for operating underwater moving object e.g. remotely operated vehicle, has upper frame that is connected to bus lines through cable, to serve as support for cage installed in lower portion of upper frame **Abstract**: The present invention relates to an underwater station and an underwater vehicle operation system and, more specifically, to an underwater station operating a plurality of underwater vehicles and an underwater vehicle operation system comprising the same. According to an embodiment of the present invention, an underwater vehicle operation system which comprises an underwater station launched into water from a mother ship and a plurality of underwater vehicles performing underwater work by starting from the underwater station; but the underwater station comprises an upper frame connected to the mother ship and a plurality of cages installed on the lower part of the upper frame providing a space to accommodate a plurality of the underwater vehicles can be provided COPYRIGHT KIPO 2014			
KR1355927B1	KOREA ADVANCED INSTITUTE FOR SCIENCE AND TECHNOLOGY	2014-01-29	2012-02-22	48
DWPI Drawing: 	**Title**: JELLYFISH-POLYP REMOVAL APPARTUS USING REMOTELY OPERATED VEHICLE AND JELLYFISH-POLYP REMOVAL ROBOT **DWPI Title**: Jellyfish-polyp removal robot has suction unit which is installed in main structure for inhaling jellyfish polyp with water and filtration unit which is detachably arranged in main structure for separating polyp from underwater **Abstract**: After the polyp in which the polyp the way to go borgon flux according to the present invention is fixed to the attached surface through wire or the wirelessly controlled unmanned submarine is floated this is inhaled with water and it filters only the inhaled polyp and it stores and the polyp has the effect that attaches and detaches the filtration part in which the polyp is stored from the unmanned submarine and separated			
KR20130096549A	KOREA ADVANCED INSTITUTE FOR SCIENCE AND TECHNOLOGY	2013-08-30	2012-02-22	48
DWPI Drawing: 	**Title**: JELLYFISH POLYP REMOVAL ROBOT USING A REMOTELY OPERATED VEHICLE, CAPABLE OF REMOVING AND COLLECTING JELLYFISH POLYPS **DWPI Title**: Jellyfish-polyp removal robot has suction unit which is installed in main structure for inhaling jellyfish polyp with water and filtration unit which is detachably arranged in main structure for separating polyp from underwater **Abstract**: PURPOSE: A jellyfish polyp removal robot using a remotely operated vehicle is provided to float jellyfish polyps fixed to an attachment surface, inhale the floating jellyfish polyps with water, and store the inhaled jellyfish polyps CONSTITUTION: A jellyfish polyp removal robot using a remotely operated vehicle (20) comprises a ship (10). The remotely operated vehicle is controlled at the ship and comprises a body, a suction part (32), a filter part (70), a discharge part (36), a filtering part, and a high-pressure jetting part (50). The suction part is installed on the body and inhales jellyfish polyps with water. The filter part filters the inhaled jellyfish polyps from the			

	water and stores the filtered jellyfish polyps therein. The discharge part discharges the water which does not have the jellyfish polyps to the outside. The filtering part inhales the water having the jellyfish polyps and discharges the water to the outside. The high-pressure jetting part is installed on the body and jets high-pressure fluid to the front of the body COPYRIGHT KIPO 2013			
CN106426204A	UNIV NORTHEAST PETROLEUM	2017-02-22	2016-11-03	38
DWPI Drawing: 	**Title**: Remote operated vehicle for welding submarine pipeline **DWPI Title**: Underwater robot for submarine pipeline welding, has connecting rod that is connected with bottom of claw table through pin shaft and recovery device recovers base of grab tube **Abstract**: A submarine pipeline underwater robot for welding. mainly composed of a ROV main body, a parallel mechanism, a supporting frame and a grabbing mechanism. the main function of the ROV main body carries the underwater welding torch to complete repair of the damaged pipeline; the main body comprises a frame, a vertical propeller and horizontal propeller, buoyant material, mechanical arm with two different degrees of freedom, underwater lighting device, a camera device and a hydraulic electric control device; between the parallel mechanism and the ROV main body rotary bearing for connecting with the two-part mechanical component can relative circumferential rotation, the pose adjustment, enlarges the welding robot working range and performs complex pipeline welding repairing support frame by welding structural frame form; grabbing mechanism is basically composed of parallelogram mechanism, the two sides of the hydraulic cylinder so as to change the parallelogram shape and form and the rod by controlling the extension and retraction to grip different diameters of submarine pipeline. The underwater robot for underwater welding damage of the submarine pipeline			
KR1644591B1	MOTORWEL CO LTD	2016-08-02	2013-09-30	28
DWPI Drawing: 	**Title**: AMPHIBIOUS ROV **DWPI Title**: Amphibious remotely operated vehicle, has insertion protrusion part combined with side of primary main body, where guide projection part of primary main body is combined with side of secondary main body **Abstract**: The present invention relates to the amphibious remote operation vehicle, and according to the invention, it is made up of the wheel of the screw type combined in the side of the secondary body and the first main body which includes the first main body, and the side of the guide projection and the secondary body as long as it is prepared to be symmetrical to multiple. The first main body and the secondary body the bond angle is controlled by the joint structure combination of the insertion protrusion and guide projection and the progressive direction of the progressive direction of the land of the 1·2 body and resolution are comprised the mutual orthogonal with multiple wheels and the 1·2 body is steered due to the wheel each rotation speed difference. As to the first main body, the guide projection of pair is equipped in the front end face. As to the side of the guide projection and the secondary body, the insertion protrusion combined in a pair of guide projections is equipped in the cross-section of throat			
KR20150368888A	MOTORWEL CO LTD	2015-04-08	2013-09-30	28
DWPI Drawing:	**Title**: AMPHIBIOUS ROV **DWPI Title**: Amphibious remotely operated vehicle, has insertion protrusion part combined with side of primary main body, where guide projection part of primary main body is combined with side of secondary main body **Abstract**: The present invention relates to an amphibious ROV. According to the present invention, the amphibious ROV comprises: a first body where a pair of symmetric guide protrusions are installed on one side; a second body where insertion protrusions, which are combined to the guide			

	protrusions, are installed on one side; and multiple wheels combined with sides of the first and second bodies. The first and second bodies are adjusted in combination angle by a coupling of the guide protrusions and the insertion protrusions. The multiple wheels have a screw shape. The first and second bodies move on the land in a direction orthogonal to a traveling direction on the sea by the wheels COPYRIGHT KIPO 2015 REPRESENTATIVE DRAWING - Reference numerals: (BB) Wheel rotation; (AA) Moving direction			
CN206230551U	ZHENJIANG WATERCRAFT COLLEGE PLA	2017-06-09	2016-12-09	20
DWPI Drawing: 	**Title**: ROV frame construction **DWPI Title**: Remotely operated vehicle frame structure has frame, which is composed of transverse rod and vertical rod, where vertical rod is vertically welded and formed, and frame bottom connected with inclined block by groups is vertically staggered **Abstract**: The utility model claims a frame structure for ROV. the ROV frame structure, wherein the frame is composed of a transverse rod and a vertical rod is vertically welded and forming; the frame bottom rail vertical staggered formed by two groups, two sides wherein a group of cross rods are connected with an inclined block, the inclined block extending outwards based on the cross and form an acute angle with the horizontal plane; the bottom and the middle part of the frame is paved with mutually parallel flat plate; the top face of the frame connect with four propeller fixing rod set in rhombus; the top surface of the frame is further provided with symmetrically arranged triangular bracket, connected with a cable mounting member between the top end of the two triangular bracket. one side of the frame top surface provided with two diagonal inclined forwards, with a camera fixing rod is connected between two inclined rod. the ROV frame structure of this utility model is compact, easy to install and to remodel and temporary equipment, the whole frame structure is stable and firm according to the working environment, the ROV on underwater work is not easy because of bearing underwater pressure and damaged			
US5550758A	GENERAL ELECTRIC COMPANY	1996-08-27	1994-03-29	7
DWPI Drawing: 	**Title**: Augmented reality maintenance system with flight planner **DWPI Title**: Remote maintenance system for inspection and repair of structures displays image of remotely operated vehicle and its environment and allows user to select path for it **Abstract**: An enhanced reality maintenance system for operating in a hazardous or inaccessible environment employs an environment modeler which is supplied with spatial parameters of a given environment and creates a computer model of the environment. An environment renderer creates a plurality of images, each corresponding to a viewing location and orientation, `viewpoint`. A remotely operated vehicle (ROV) attached to a base unit by a tether cord or radio link navigates in the environment. The ROV has a spatial imaging device, such as a video camera, and actuators which propel it through the environment. Its position and orientation are determined by a position and attitude (P & A) sensing unit, and are passed to an ROV renderer which creates an image of a prestored model of the ROV having the same location and orientation as the ROV and viewed from a specified viewpoint. The viewpoints may be predetermined, provided to the system or may be interactively determined as an offset from the ROV position and orientation. Alternative embodiments include an image archive and comparison unit capable of storing images linked to information of the image acquisition, retrieving stored images with the image acquisition into and transforming one of the images to match the image acquisition information of the other image			

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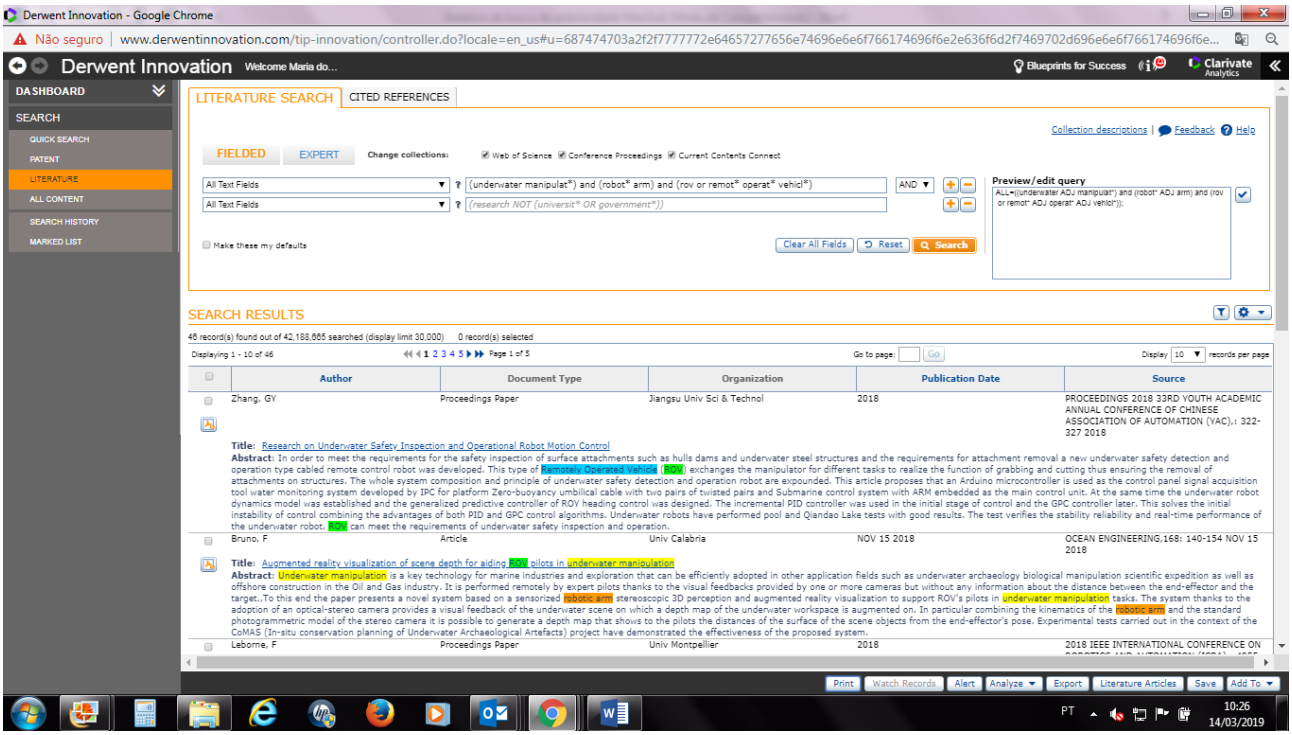

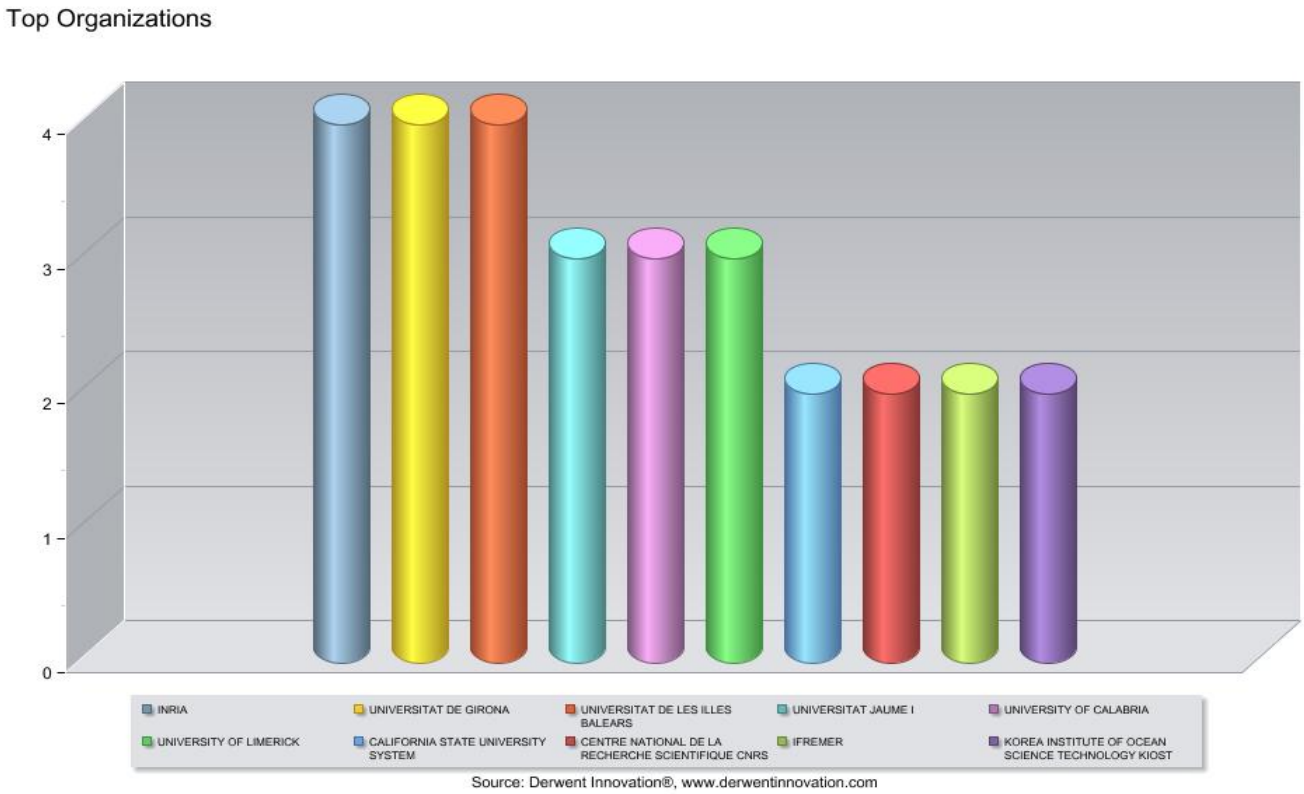

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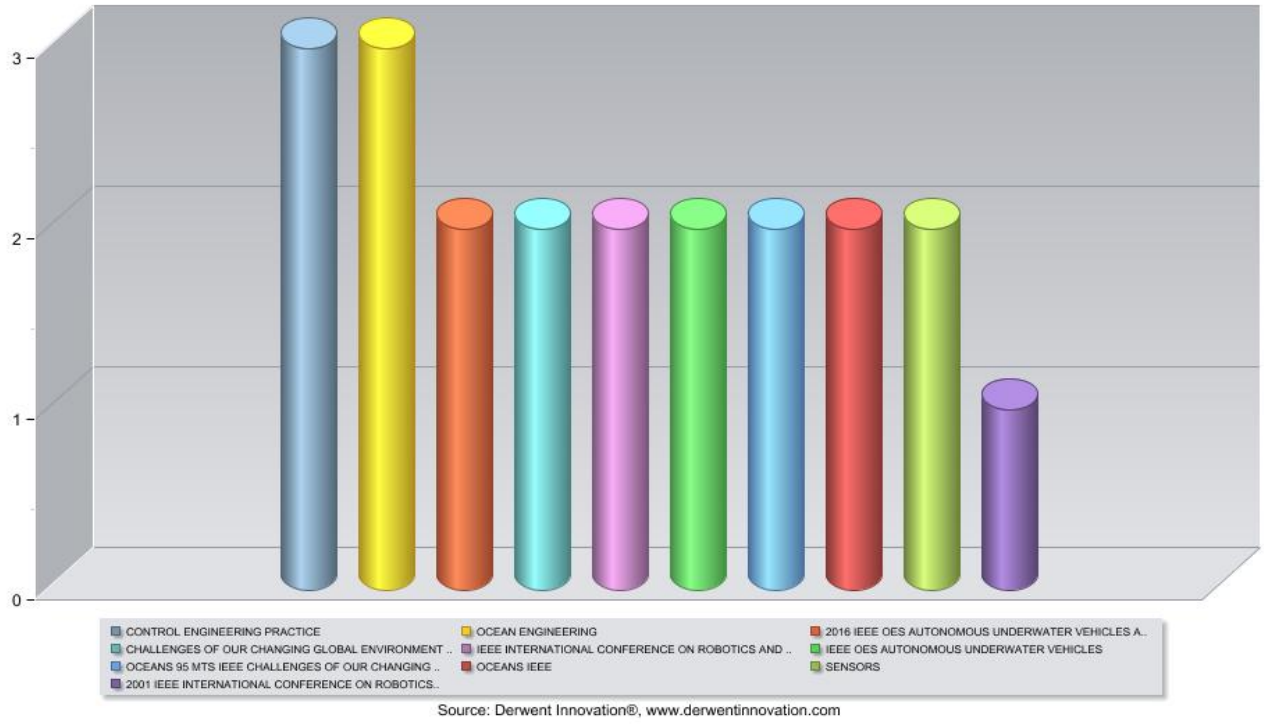

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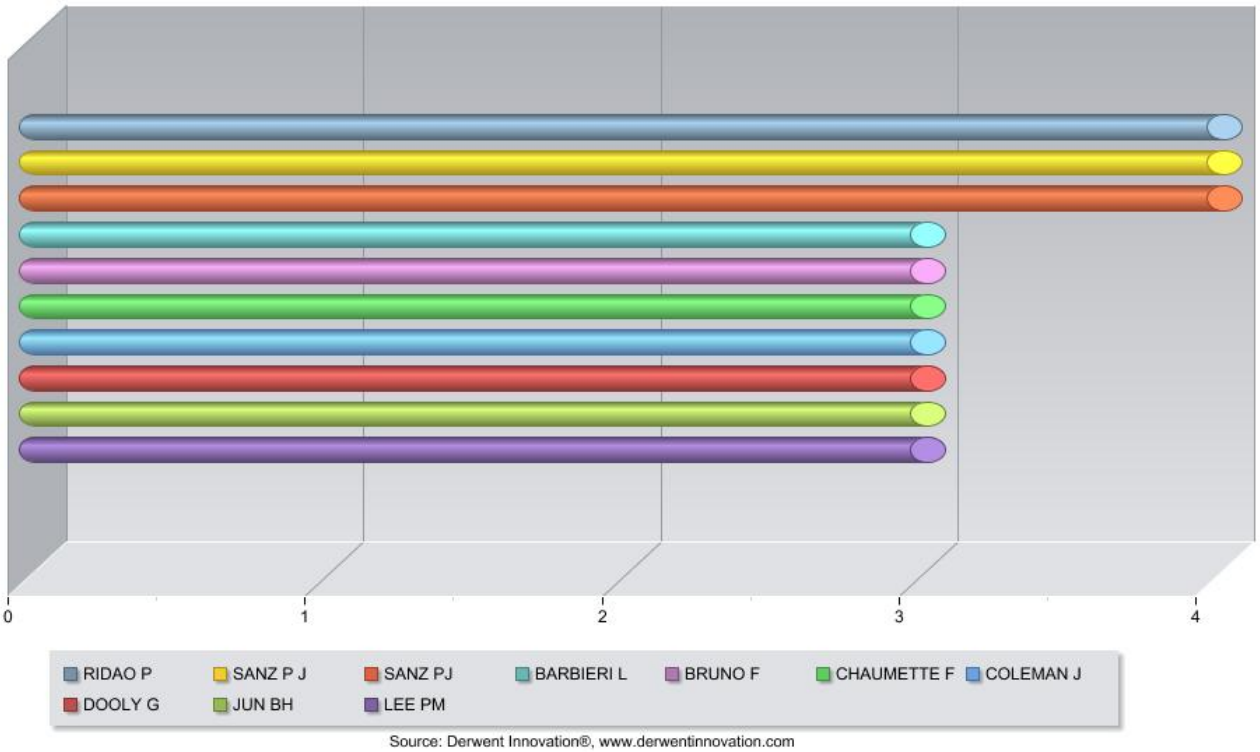

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LITERATURE RESULT SET Thursday, March 14 2019 Derwent Innovation

Search results for: ALL=((underwater ADJ manipulat*) and (robot* ADJ arm) and (rov or remot* ADJ operat* ADJ vehicl*));
Collections searched: Web of Science, Conference Proceedings, Current Contents Connect

46 record(s) found out of 42,188,665 searched (display limit 30,000) 0 record(s) selected

Author	Document Type	Organization	Publication Date	Source
Zhang, GY	Proceedings Paper	Jiangsu Univ Sci & Technol	2018	PROCEEDINGS 2018 33RD YOUTH ACADEMIC ANNUAL CONFERENCE OF CHINESE ASSOCIATION OF AUTOMATION (YAC) : 322-327 2018

Title: Research on Underwater Safety Inspection and Operational Robot Motion Control
Abstract: In order to meet the requirements for the safety inspection of surface attachments such as hulls, dams, and underwater steel structures and the requirements for attachment removal, a new underwater safety detection and operation type cabled remote control robot was developed. This type of Remotely Operated Vehicle (ROV) exchanges the manipulator for different tasks to realize the function of grabbing and cutting, thus ensuring the removal of attachments on structures. The whole system composition and principle of underwater safety detection and operation robot are expounded. This article proposes that an Arduino microcontroller is used as the control panel signal acquisition tool, water monitoring system developed by IPC for platform, Zero-buoyancy umbilical cable with two pairs of twisted pairs, and Submarine control system with ARM embedded as the main control unit. At the same time, the underwater robot dynamics model was established and the generalized predictive controller of ROY heading control was designed. The incremental PID controller was used in the initial stage of control and the GPC controller later. This solves the initial instability of control, combining the advantages of both PID and GPC control algorithms. Underwater robots have performed pool and Qiandao Lake tests with good results. The test verifies the stability, reliability and real-time performance of the underwater robot. ROV can meet the requirements of underwater safety inspection and operation.

Bruno, F	Article	Univ Calabria	NOV 15 2018	OCEAN ENGINEERING 168: 140-154 NOV 15 2018

Title: Augmented reality visualization of scene depth for aiding ROV pilots in underwater manipulation
Abstract: Underwater manipulation is a key technology for marine industries and exploration that can be efficiently adopted in other application fields, such as underwater archaeology, biological manipulation, scientific expedition, as well as offshore construction in the Oil and Gas industry. It is performed remotely by expert pilots thanks to the visual feedbacks provided by one or more cameras but without any information about the distance between the end-effector and the target.

To this end, the paper presents a novel system based on a sensorized robotic arm, stereoscopic 3D perception and augmented reality visualization to support ROV's pilots in underwater manipulation tasks. The system, thanks to the adoption of an optical-stereo camera, provides a visual feedback of the underwater scene on which a depth map of the underwater workspace is augmented on. In particular, combining the kinematics of the robotic arm and the standard photogrammetric model of the stereo camera, it is possible to generate a depth map that shows to the pilots the distances of the surface of the scene objects from the end-effector's pose. Experimental tests carried out in the context of the CoMAS (In-situ conservation planning of Underwater Archaeological Artefacts) project have demonstrated the effectiveness of the proposed system.

Leborne, F	Proceedings Paper	Univ Montpellier	2018	2018 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION (ICRA) : 4955-4960 2018
Title: Dynamic Modeling and Identification of an Heterogeneously Actuated Underwater Manipulator Arm **Abstract:** This paper deals with the dynamic modeling and identification of an electrically driven underwater robot manipulator. The proposed study includes the dynamic modeling of the actuators of the arm as well as the identification of the parameters of the model. The proposed method deals with the specific case of heterogeneously actuated arms, namely arms with actuators behaving differently for each joint, being considered at the kinematic level. Indeed, we show how to estimate the arms parameters when some of their revolute joints are directly actuated by geared motors, while the others are actuated by linear actuators. A minimum set of identifiable parameters is determined, and adequate excitation trajectories are generated and used in the identification procedure. Real-time experimental validation on the manipulator arms of Ifremer's HROV (Hybrid Remotely Operated Vehicle) Ariane underwater vehicle demonstrates that the proposed method improves the estimation of the dynamic model.				
Barbieri, L	Article	Univ Calabria	JUN 15 2018	OCEAN ENGINEERING 158: 253-262 JUN 15 2018
Title: Design, prototyping and testing of a modular small-sized underwater robotic arm controlled through a Master-Slave approach **Abstract:** Underwater exploration, in the last years, has evolved toward a wide adoption of increasingly smaller ROVs (Remotely Operated Vehicle). As a consequence, the need to equip these underwater vehicles with robotic arms is currently rising as well. According to this demand, the paper presents three innovative solutions achieved in the UVMS (Underwater Vehicle-Manipulator System) field. Firstly, the paper proposes a modular architecture for a lightweight underwater robotic arm, which can be mounted on small-sized ROVs. The modular concept of the arm enables several different configurations, each one characterized by the related DOFs, deployed according to the type of application to be performed. Secondly, the arm has been equipped with an adaptive gripper that, taking advantage of the additive manufacturing techniques, is able to easily grip differently shaped objects. Lastly, the underwater arm is controlled through a Master-Slave approach, designed for commercial off-the-shelf electronics, that on the one hand, entailed a significant reduction of the bill of materials, but, on the other hand, required a greater effort in the software development. Experimental tests have been carried out to measure and evaluate the gripping and manipulation capability of the robotic arm and the performance of the proposed control system.				
Sivcev, S	Review	MaREI Marine & Renewable Energy	SEP 1 2018	OCEAN ENGINEERING 163: 431-450 SEP 1 2018
Title: Underwater manipulators: A review **Abstract:** This paper describes the state-of-the art in the area of underwater robot manipulator systems. A brief introduction is given on the use of manipulators in various offshore industries for different subsea intervention applications. It provides a comprehensive summary of existing commercial and prototype underwater manipulators, covering relevant aspects such as design features, their capabilities and merits, and provides a detailed comparison. This is followed by a thorough analysis of advantages and disadvantages of both electrically and hydraulically actuated manipulators. Furthermore, a detailed description of commercially available underwater manipulator control systems is presented in order to provide a realistic picture of the existing technology and its limitation. In addition, an extensive bibliography covering research results in the field of control algorithms is presented, including low level motion control, high level				

kinematic control and motion planning schemes along with the implementation issues.				
Kurumaya, S	Article	Tokyo Inst Technol	AUG 2018	SOFT ROBOTICS 5 (4): 399-409 AUG 2018
Title: A Modular Soft Robotic Wrist for Underwater Manipulation **Abstract:** This article presents the development of modular soft robotic wrist joint mechanisms for delicate and precise manipulation in the harsh deep-sea environment. The wrist consists of a rotary module and bending module, which can be combined with other actuators as part of a complete manipulator system. These mechanisms are part of a suite of soft robotic actuators being developed for deep-sea manipulation via submersibles and remotely operated vehicles, and are designed to be powered hydraulically with seawater. The wrist joint mechanisms can also be activated with pneumatic pressure for terrestrial-based applications, such as automated assembly and robotic locomotion. Here we report the development and characterization of a suite of rotary and bending modules by varying fiber number and silicone hardness. Performance of the complete soft robotic wrist is demonstrated in normal atmospheric conditions using both pneumatic and hydraulic pressures for actuation and under high ambient hydrostatic pressures equivalent to those found at least 2300m deep in the ocean. This rugged modular wrist holds the potential to be utilized at full ocean depths (>10, 000m) and is a step forward in the development of jointed underwater soft robotic arms.				
Sivcev, S	Article	MaREI Marine & Renewable Energy	MAY 2018	CONTROL ENGINEERING PRACTICE 74: 153-167 MAY 2018
Title: Fully automatic visual servoing control for work-class marine intervention ROVs **Abstract:** ROVs with hydraulic manipulators are extensively used for subsea intervention. With camera feedback from the scene, manipulators are teleoperated and slaved to pilot held master arms. While standard for offshore oil and gas, for challenging applications in waves or currents a new approach is required. We present development of robot arm visual servo control approaches used in manufacturing and the transfer and adaption of these to underwater hydraulic manipulators. This is the first time a visual servoing algorithm for automated manipulation has been developed and verified, through subsea trials, on a commercial work-class ROV with industry standard hydraulic manipulators.				
Sivcev, S	Article	MaREI Marine & Renewable Energy Ireland	APR 2018	SENSORS 18 (4): - APR 2018
Title: Collision Detection for Underwater ROV Manipulator Systems **Abstract:** Work-class ROVs equipped with robotic manipulators are extensively used for subsea intervention operations. Manipulators are teleoperated by human pilots relying on visual feedback from the worksite. Operating in a remote environment, with limited pilot perception and poor visibility, manipulator collisions which may cause significant damage are likely to happen. This paper presents a real-time collision detection algorithm for marine robotic manipulation. The proposed collision detection mechanism is developed, integrated into a commercial ROV manipulator control system, and successfully evaluated in simulations and experimental setup using a real industry standard underwater manipulator. The presented collision sensing solution has a potential to be a useful pilot assisting tool that can reduce the task load, operational time, and costs of subsea inspection, repair, and maintenance operations.				
Rizzo, D	Proceedings Paper	Univ Calabria	2017	OCEANS 2017 - ABERDEEN : - 2017

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Title: Kinematic performances evaluation of a hydraulic underwater manipulator
Abstract: Underwater manipulation is an essential operation for performing a diverse range of applications in the submerged environment that, in spite of the hostile and unstructured environment, it requires high precision and reliability of the robotic arm. The paper presents the evaluation and characterization of the kinematic performances of an underwater robotic arm mounted on a light work class ROV. The arm analyzed in the study is a re-engineered version of a commercial hydraulic manipulator whose geometry and end-effector have been modified. Moreover, the arm has been equipped with a set of encoders in order to provide the positioning feedback. The test conducted in laboratory focused on the measurement of accuracy and repeatability in order to evaluate the limits of the arm architecture. This work has been carried out in the context of the CoMAS (In situ conservation planning of Underwater Archaeological Artifacts - http://www.comasproject.eu) project in which the possibility to develop a ROV able to perform maintenance operations in underwater archeological sites has been investigated.

Kazakidi, A	Proceedings Paper	Univ Strathclyde	2017	IFAC PAPERSONLINE 50 (1): 2304-2309 2017

Title: Impact of Arm Morphology on the Hydrodynamic Behavior of a Two-arm Robotic Marine Vehicle
Abstract: Increasing the functionality and efficiency of small underwater marine robotic systems has been a significant challenge, particularly regarding their use in tasks requiring enhanced maneuverability, long-distance travel and delicate underwater manipulation of objects. In this paper, we explore the impact of bio-inspired arm morphology on underwater propulsion, through examination of the generated hydrodynamic forces and the corresponding complex vortical patterns in the wake of a novel two-arm underwater robotic swimmer, inspired by the octopus arm-swimming behavior. We demonstrate for the first time, via detailed modelling and CFD studies, the use of a variety of slender arm morphologies as thrust actuators in a system that can achieve forward propulsion, by the slow opening and rapid closing of these arms ("arm sculling"), while minimizing the lateral excursion of the system. Robotic prototypes, based on such principles, have already been used by our group to observe marine ecosystems, without disturbing them as much as current ROVs. Further applications of such robotic systems could be envisioned in future medical rehabilitation studies. (C) 2017, IFAC (International Federation of Automatic Control) Hosting by Elsevier Ltd. All rights reserved.

Mardiyanto, R	Proceedings Paper	Inst Teknol Sepuluh Nopember	2017	2017 INTERNATIONAL SEMINAR ON INTELLIGENT TECHNOLOGY AND ITS APPLICATIONS (ISITIA) : 329-333 2017

Title: Development of Hand Gesture Recognition Sensor Based on Accelerometer and Gyroscope for Controlling Arm of Underwater Remotely Operated Robot
Abstract: Hand Gesture Recognition sensor based on accelerometer and gyroscope is a sensor for capturing the positions of operator hand while controlling underwater remotely operated vehicle equipped with an arm. The proposed system has an advantage in its convenience by means of no training or exercise needed for operator before using it. The key issue here is how beginner operator could use easily the underwater remotely operated robot arm without any specific training. The conventional one uses a joystick for controlling the underwater system and it is inconvenience for beginner user as well as less precision. The proposed system consists of two main part: (1) ground station and (2) underwater remotely operated robot arm. This paper proposes the development of hand gesture recognition sensor used by operator at the ground station for controlling robot arm at the underwater robot. The proposed sensor uses accelerometers and gyroscopes installed in elbow, forearm, and wrist. These devices measure 3D position of each joints for constructing 3D position of hand. We design sensor's casing for its convenience of use by using CAD software. Each sensor is connected by Arduino Nano microcontroller having compact circuit and embedded it into sensor's casing. The sensors are connected to a microcontroller acting as master connected to microcontroller slave (sensor part). These sensors value are converted to 3D position by using forward kinematic.

The forward kinematic values are sent to the underwater robot by using a wire utilizing Pulse Position Signal. Then, it converted again to servo's movement by using inverse kinematic. The result is operator able to control the underwater remotely robot arm by utilizing hand gesture directly. The last, operator could control the robot gripper based on flex sensor installed in operator's fingers. The accuracy of the sensor has been tested under laboratory condition, it has 98% of accuracy.				
Qiao, L	Proceedings Paper	Shanghai Jiao Tong Univ	2016	PROCEEDINGS OF THE 35TH CHINESE CONTROL CONFERENCE 2016 : 5780-5785 2016
Title: Robust Adaptive PID Control for Positioning of Remotely Operated Vehicle Working in Close Proximity of an Underwater Structure **Abstract:** Precise measurement of remotely operated vehicle (ROV) position is crucial for dynamic positioning close to an underwater structure. This can be achieved by using a passive arm measurement system. However, the main drawback of this measurement system is the additional forces acting on ROV due to the mechanical connection. To cope with this problem, a robust adaptive PID control scheme is proposed for dynamic positioning of ROV working in close proximity of an underwater structure in this paper. The proposed controller is a composition of a PID term, a robust term and an adaptive term. The adaptive term is adopted to estimate and compensate the additional forces caused by the passive arm, umbilical cable and uncertainties in buoyancy, and the PID and robust terms are used to eliminate the positioning errors. With respect to the existing adaptive PD controller developed for dynamic positioning of ROV, the proposed controller makes the following improvements: 1) it does not require any knowledge of the inertia matrix, Coriolis and centripetal matrix and hydrodynamic damping matrix of the vehicle dynamics in the controller design; and 2) it does not need any constraints on the control gains to guarantee the global asymptotical convergence of the position and velocity errors of the vehicle to zero except for choosing an appropriately large exponential decay rate. Finally, comparative numerical simulations are performed on an experimentally validated ROVbetween the standard PID controller and the proposed robust adaptive PID controller. Simulation results show that the proposed controller offers higher positioning precision and stronger robustness to the additional forces than the standard PID controller.				
Zhang, J	Article	Chinese Acad Sci	FEB 2017	IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS 64 (2): 1716-1727 FEB 2017
Title: Development of a Virtual Platform for Telepresence Control of an Underwater Manipulator Mounted on a Submersible Vehicle **Abstract:** This paper develops a virtual platform of an underwater manipulator mounted on a submersible vehicle via the three-dimensional simulator "Webots" for teleoperation through a replica master arm. The graphical, kinematic, and dynamic models of the manipulator refer to a master-slave servo hydraulic manipulator with seven functions, consisting of six degrees of freedom and a parallel gripper, while the "Jiaolong" deep-manned submersible vehicle, operating below the sea surface down to 7000 m, is chosen as the underwater manipulator carrier. This study uses the virtual platform for training an operator to telepresence control the virtual manipulator to complete basic tasks in subsea environments. When training the operator, one has to consider uncertain external disturbances and the visual impacts that stem from subsea environments. In order to demonstrate the feasibility and effectiveness of the virtual platform, one designs two typical underwater operational tasks: grasping a marine organism sample and reaching at a given position. This paper presents the comparative studies: 1) the performances demonstrated by remotely controlling the virtual manipulator and the real manipulator; 2) the operating performances delivered by three operators before and after training when using the platform.				
Sverdrup-Thygeson, J	Proceedings Paper	Norwegian Univ Sci & Technol	2016	2016 IEEE/OES AUTONOMOUS UNDERWATER VEHICLES (AUV) : 387-395 2016
Title: The Underwater Swimming Manipulator - A Bio-Inspired AUV **Abstract:** Autonomous underwater vehicles (AUVs) have been used for environmental mapping and surveys of various kinds for some time. More recently, the AUVs have entered the domain of the remotely operated vehicles (ROVs) to tackle some of the lighter subsea				

operations, such as inspection, maintenance, and repair (MIR) and light intervention tasks. The successful transition to AUVs for inspection of subsea infrastructure has pushed the technology towards AUVs equipped with robotic arms. Some AUVs with attached manipulator arms have demonstrated autonomous light intervention, but the majority of such tasks are still carried out using tethered and expensive ROVs with support vessels. The underwater swimming manipulator (USM) presented in this paper, is a snakelike bio-inspired AUV with exceptional accessibility and flexibility, due to its slender, multi-articulated structure. In this paper, we discuss why the USM is an appropriate system for certain tasks that are normally carried out by conventional ROVs and AUVs. Furthermore, we address the topic of kinematic control of the USM to utilize the inherent redundancy. Finally, we present and make use of a newly developed and versatile simulation environment for USMs to assert the applicability of the USM for performing subsea inspections and light intervention.

Kim, J	Proceedings Paper	Pohang Univ Sci & Technol	2016	2016 IEEE/OES AUTONOMOUS UNDERWATER VEHICLES (AUV) : 396-400 2016

Title: Convolutional Neural Network-based Real-time ROV Detection Using Forward-looking Sonar Image
Abstract: Agent system is strategy to enhance the underwater manipulation. The conventional manipulation is generally robot arm-based configuration which has singular points. On the other hand, the agent system is an armless manipulation that the agent vehicle works as the end-effector. If the location of the agent can be measured, the end effector is able to be place to any position. To implement this system, the method of an agent vehicle localization is proposed. The method uses the sonar images of moving agent obtained by forward-looking sonar. To detect the location of the agent in the sonar images, the convolutional neural network is applied. We applied the state-of-art object-detection algorithm to the agent vehicle system. The fast object-detection algorithm based on neural network can fulfil the real-time detection and show the remarkable validity. It means the underwater robot can begin navigation under its feed-back. Through field experiment, we confirm the proposed method can detect and track the agent in the successive sonar images.

Palomeras, N	Article	Univ Girona	OCT 2016	SENSORS 16 (10): - OCT 2016

Title: I-AUV Docking and Panel Intervention at Sea
Abstract: The use of commercially available autonomous underwater vehicles (AUVs) has increased during the last fifteen years. While they are mainly used for routine survey missions, there is a set of applications that nowadays can be only addressed by manned submersibles or work-class remotely operated vehicles (ROVs) equipped with teleoperated arms: the intervention applications. To allow these heavy vehicles controlled by human operators to perform intervention tasks, underwater structures like observatory facilities, subsea panels or oil-well Christmas trees have been adapted, making them more robust and easier to operate. The TRITON Spanish founded project proposes the use of a light-weight intervention AUV (I-AUV) to carry out intervention applications simplifying the adaptation of these underwater structures and drastically reducing the operational cost. To prove this concept, the Girona 500 I-AUV is used to autonomously dock into an adapted subsea panel and once docked perform an intervention composed of turning a valve and plugging in/unplugging a connector. The techniques used for the autonomous docking and manipulation as well as the design of an adapted subsea panel with a funnel-based docking system are presented in this article together with the results achieved in a water tank and at sea.

Zereik, E	Proceedings Paper	UoS Genova	2015	OCEANS 2015 - GENOVA : - 2015

Title: 3D-Belief Space Planning for underwater mobile grasping
Abstract: In the present work, a method based on belief space planning, assuming maximum likelihood of the observations, is applied to the planning of manipulation for an underwater robotic arm. The manipulator is rigidly connected to a floating platform, such as

a ROV(Remotely Operated Vehicle) or an AUV (Autonomous Underwater Vehicle). The arm and platform motions are statistically independent from the motion of the object to be grasped. The belief space planning strategy allows to plan the reaching movement with the objectives of concurrently reducing the end-effector distance from the target and the uncertainty on the measure. In this paper the implementation of belief space planning assuming maximun observation likelihood is reported and is applied to an industrial class of underwater arm modelled as purely deterministic. Results obtained by the proposed strategy within preliminary experiments in air are here provided.				
Ridao, P	Review	Sci & Technol Pk Univ Girona	2015	ANNUAL REVIEWS IN CONTROL 40: 227-241 2015
Title: Intervention AUVs: The next challenge **Abstract:** While commercially available AUVs are routinely used in survey missions, a new set of applications exist which clearly demand intervention capabilities. The maintenance of permanent underwater observatories, submerged oil wells, cabled sensor networks, pipes and the deployment and recovery of benthic stations are a few of them. These tasks are addressed nowadays using manned submersibles or work-class ROVs, equipped with teleoperated arms under human supervision. Although researchers have recently opened the door to future I-AUVs, a long path is still necessary to achieve autonomous underwater interventions. This paper reviews the evolution timeline in autonomous underwater intervention systems. Milestone projects in the state of the art are reviewed, highlighting their principal contributions to the field. To the best of the authors' knowledge, only three vehicles have demonstrated some autonomous intervention capabilities so far: ALIVE, SAUVIM and GIRONA 500, being the last one the lightest one. In this paper GIRONA 500 I-AUV is presented and its software architecture discussed. Recent results in different scenarios are reported: (I) valve turning and connector plugging/unplugging while docked to a subsea panel, (2) free floating valve turning using learning by demonstration, and (3) multipurpose free-floating object recovery. The paper ends discussing the lessons learned so far. (C) 2015 International Federation of Automatic Control. Published by Elsevier Ltd. All rights reserved.				
Stanway, MJ	Article	Monterey Bay Aquarium Res Inst	AUG 2015	JOURNAL OF FIELD ROBOTICS 32 (5): 632-654 Sp. Iss. SI AUG 2015
Title: Rotation Identification in Geometric Algebra: Theory and Application to the Navigation of Underwater Robots in the Field **Abstract:** We report the derivation and experimental evaluation of a stable adaptive identifier to estimate rigid body rotations using rotors in Geometric Algebra (GA). This work is motivated by the need for in situ estimation of the alignment between sensors commonly used in underwater vehicle navigation. Here we derive an adaptive identifier using a geometric interpretation of the error to drive first-order rotor kinematics. We prove that it is Lyapunov stable, and we show that it is asymptotically stable in the presence of persistent excitation. We use the identifier to estimate the alignment between the Doppler velocity log sonar and the fiber optic gyrocompass used by underwater vehicles for dead reckoning (DR). We evaluate this method in the laboratory with a remotely operated vehicle (ROV), and then with an autonomous underwater vehicle (AUV) operating in the field at 1, 200m depth. Our results show that this technique reduces dead reckoning navigation errors on these platforms and provides comparable performance to previously reported SO(3) constrained Linear Algebra (LA) approaches. The rotor identifier has a number of advantages over these previously reported methods, including a more straightforward derivation, simpler gain tuning, increased computational efficiency, and reduced data manipulation.				
Palomeras, N	Proceedings Paper	Univ Girona	2014	2014 IEEE/RSJ INTERNATIONAL CONFERENCE ON INTELLIGENT ROBOTS AND SYSTEMS (IROS 2014) : 2279-2285 2014

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RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

Pesquisa em documentos de patentes e literatura científica

Title: I-AUV Docking and Intervention in a Subsea Panel **Abstract:** While commercially available autonomous underwater vehicles (AUVs) are routinely used in survey missions, a new set of applications exist which clearly demand intervention capabilities: the maintenance of permanent underwater structures as well as the recovery of benthic stations or black-boxes are a few of them. These tasks are addressed nowadays using manned submersibles or work-class remotely operated vehicles (ROVs), equipped with teleoperated arms under human supervision. In the context of the TRITON Spanish funded project, a subsea panel docking and an intervention procedure are proposed. The light-weight intervention AUV (I-AUV) Girona 500 is used to autonomously dock into a subsea panel using a funnel-based docking method for passive accommodation. Once docked, an autonomous fixed-based manipulation system, which uses feedback from a digital camera, is used to turn a valve and plug/unplug a connector. The paper presents the techniques used for the autonomous docking and manipulation as well as how the adapted subsea panel has been designed to facilitate such operations.				
Poretti, M	Proceedings Paper	Calif Polytech State Univ San Luis Obispo	2013	2013 OCEANS - SAN DIEGO : - 2013
Title: Design of Modular Camera Tool for Mini Underwater ROVs **Abstract:** Remotely operated vehicles are an essential tool for marine researchers and workers. Their robust nature allows them to serve a wide range of purposes, such as remote visual inspection or tool operation. Cameras are the main method for providing operator feedback to the surface. They enable an operator to accurately maneuver or handle objects up to thousands of feet away. Although large ROVs have cameras attached to their robotic arms for closer inspection of objects, min ROVs do not have cameras attached to their robotic arms because no camera tool has been specifically designed to support he low-cost, lightweight design of a mini ROV. Therefore, this paper discusses the design considerations, component selection, and system prototype of an affordable modular underwater camera tool for mini ROV robotic manipulators.				
Liu, WD	Proceedings Paper	Northwestern Polytech Univ	2012	SUSTAINABLE CITIES DEVELOPMENT AND ENVIRONMENT, PTS 1-3 209-211: 2138-2141 Part 1-3 2012
Title: Design of a gateway for remotely underwater vehicles **Abstract:** A gateway based on ARM is presented to achieve mutil-protocol conversion among different electronic control units. To guarantee its real-time ability and stability, the mu C/OS-II embedded operation system was adopted. The first-in-first-out data queue is used to balance the communication rate among the different communication protocols which consist of the Controller Area Network, TCP/IP and RS-232. The gateway can be used in remotely manipulation between the console with Ethernet and remote underwater vehicle with other serial communication protocols.				
Bonsignorio, F	Proceedings Paper	Heron Robots	2012	FIELD ROBOTICS : 873-880 2012
Title: STOCHASTIC CONTROLLERS FOR ROBUST UNDERWATER MOBILE MANIPULATION **Abstract:** In this paper the technological underpinnings of a novel robust underwater manipulation controller platform currently under development by Heron Robots are briefly described. Underwater visual servoed manipulation performed by a dexterous arm connected to a ROV (Remotely Operated Vehicle) or an AUV (Autonomous Underwater Vehicle) can be seen as a (hard) mobile manipulation problem, as the arm base is rigidly connected to a platform whose motion is stochastically independent from the object motion, from a mechanical standpoint. In our design the 'reaching behaviors' are not be pre-designed, their instantiation builds and expands on recently proposed techniques using belief space planning maximum likelihood observations. They will be made more efficient by a high level functional				

representation of the configuration space of the mobile manipulation task, based on invariant and constraint properties of displacement (Lie) groups. The adoption of such a canonical representation of both the kinematics and the dynamics of the manipulation action will allow the accurate parameterization of the hand-object relations to characterize the phase space portrait of the overall system and reduce the search space of the planning algorithm. We are implementing a probabilistic kinematic planning of the manipulation task involving the modeling of nonholonomic movement of the manipulator platform: the platform moves naturally for the water streams and moves in a partially actuated way to ease the manipulation. The key scientific objective is the development of robust planning and control algorithms for the underwater mobile manipulation and robust mobile manipulation in general.

De Novi, G	Article	UNIBO	NOV 2010	IEEE AEROSPACE AND ELECTRONIC SYSTEMS MAGAZINE 25 (11): 32-36 NOV 2010

Title: New Approach for a Reconfigurable Autonomous Underwater Vehicle for Intervention
Abstract: This shows an on-going project named RAUVI (i.e., Reconfigurable AUV for Intervention). This project aims to design and develop an Underwater Autonomous Robot, able to perceive the environment by means of acoustic and optic sensors, and equipped with a robotic arm in order to autonomously perform simple intervention tasks. A complete simulation environment, including this new concept of rob., has been developed and is presented as a preliminary result.

Whitcomb, LL	Proceedings Paper	Johns Hopkins Univ	2010	2010 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION (ICRA) : 594-600 2010

Title: Navigation and Control of the Nereus Hybrid Underwater Vehicle for Global Ocean Science to 10, 903 m Depth: Preliminary Results
Abstract: This paper reports an overview of the navigation and control system design for the new Nereus hybrid underwater robotic vehicle (HROV). Vehicle performance during its first sea trials in November 2007 near Hawaii, and in May and June 2009 in the Challenger Deep of the Mariana Trench is reported. During the latter expedition, the vehicle successfully performed scientific observation and sampling operations at depths exceeding 10, 903 m. The Nereus underwater vehicle is designed to perform scientific survey and sampling to the full depth of the ocean - significantly deeper than the depth capability of all other present-day operational vehicles. For comparison, the second deepest underwater vehicle currently operational worldwide can dive to 7, 000 m maximum depth. Nereus operates in two different modes. For broad-area survey, the vehicle can operate untethered as an autonomous underwater vehicle (AUV) capable of exploring and mapping the sea floor with sonars and cameras. Nereus can be converted at sea to become a tethered remotely operated vehicle (ROV) to enable close-up imaging and sampling. The ROV configuration incorporates a lightweight fiber-optic tether (for high-bandwidth, real-time video and data telemetry to the surface), an electro-hydraulic manipulator arm, and sampling instruments. The Nereus vehicle is designed to render all parts of the Earth's seafloor accessible to oceanographic science.

Jun, BH	Article	Korean Intellectual Property Off	MAY 2008	JOURNAL OF MECHANICAL SCIENCE AND TECHNOLOGY 22 (5): 887-894 MAY 2008

Title: Manipulability analysis of underwater robotic arms on ROV and application to task-oriented joint configuration
Abstract: This paper describes the task-oriented manipulability of tele-operated robotic arms mounted on a remotely operated vehicle(ROV) and its application to task-oriented joint configurations. The main purpose of the study is to reduce the tele-operator's burden in performing underwater tasks by enhancing the functionality of the manipulator. Even though a manipulator has 6 degrees-of-freedom (DOF), which is proper DOF to work in Cartesian workspace, the manipulator might have redundancy according to task types and order of task-priority. This paper focuses on the problem to utilize the redundancy by introducing a scalar function as an object of optimization. The scalar function is composed of a task-oriented manipulability measure (TOMM) and joint limit measure (JLM). Using

sequential quadratic programming (SQP) with the object function, we obtained optimal postures of the manipulator for a given position constraint of the end-effecter. Adopting the scalar function as a performance index, we solved a redundancy resolution problem based on the pseudo inverse of the task-oriented Jacobian matrix.				
Zoppi, M	Article	Univ Genoa	AUG 2007	JOURNAL OF MECHANICAL DESIGN 129 (8): 808-815 AUG 2007
Title: ArmillEye: Flexible platform for underwater stereo vision **Abstract:** The paper describes ArmillEye, a 3-degree of freedom (DOF) flexible hybrid platform designed for agile underwater stereoptic vision. Effective telecontrol systems of remote operated vehicles require active and dexterous camera support in order to allow the operator to easily and promptly change the point of view, also improving the, virtual reconstruction of the environment in difficult operative conditions (dirtiness, turbulence, and partial occlusion). The same concepts hold for visual servoing of autonomous underwater vehicles. ArmillEye was designed for this specific application; it is based on the concept of using a parallel-hybrid mechanism architecture that, in principle, allows us to minimize the ad hoc waterproof boxes (generally only for cameras) while the actuators, fixed to the base of the mechanism, can be placed into the main hotly of the underwater vehicle. This concept was revealed effective and was previously proposed for underwater arms. The synthesis of ArmillEye followed the specific aims of visual telecontrol and servoing, specifying vision workspace, dexterity, and dynamics parameters. Two versions of ArmillEye are proposed: the first one with two cameras to obtain a steroptic vision by using two viewpoints (two rotational freedoms with a fixed tilt or pan axis and vergence); the second one with one camera operated to obtain a stereoptic vision by using one viewpoint (two rotational freedoms with a fixed tilt or pan axis and extrusion).				
Hoang, NQ	Article	Tech Univ Hamburg	APR 2007	CONTROL ENGINEERING PRACTICE 15 (4): 411-419 APR 2007
Title: Adaptive PD-controller for positioning of a remotely operated vehicle close to an underwater structure: Theory and experiments **Abstract:** The requirement for high accuracy in dynamic positioning of remotely operated vehicles (ROV), especially when tasks close to underwater structures have to be performed, demands high precision of sensor systems. Taut-wire and passive arm systems can satisfy this demand in measuring ROVs positions and orientations relative to a structure. However, the main drawback of these sensor systems is that additional forces act on ROVs due to the mechanical connection. In order to solve this problem, an adaptive PD controller is proposed and designed for dynamic positioning of ROVs working in close proximity of structures. Invoking the adaptation law, these additional forces caused by the passive arm and umbilical, and even by the uncertainties in gravity and buoyancy can be identified and compensated. By choosing an adequate Lyapunov candidate function, the system's stability is proven. The effectiveness of this design control method is demonstrated by means of numerical simulations and experiments. (c) 2006 Elsevier Ltd. All rights reserved.				
Hosseini, MKA	Article	Iran Marine Ind Co SADRA	MAY 2006	JOURNAL OF OFFSHORE MECHANICS AND ARCTIC ENGINEERING-TRANSACTIONS OF THE ASME 128 (2): 119-132 MAY 2006
Title: A composite rigid body algorithm for modeling and simulation of an underwater vehicle equipped with manipulator arms **Abstract:** In this paper modeling and simulation of an underwater vehicle equipped with manipulator arms, using a composite rigid body algorithm, will be discussed. Because of the increasing need for unmanned underwater vehicles (UUVs) in oil and gas projects in the Persian Gulf for doing operations such as inspection of offshore jackets, subsea pipelines, and submarine cables, and also pre-installation survey and post-laid survey of submarine pipelines and cables, design and construction of "SROV" was developed in Sharif University of Technology, and at the design stage behavior of the underwater vehicles was studied. In this paper an efficient dynamic simulation algorithm is developed for an UUV equipped with In manipulators so that each of them has N degrees of freedom. In addition to the				

effects of the mobile base, the various hydrodynamic forces exerted on these systems in an underwater environment are also incorporated into the simulation. The effects modeled in this work are added mass, viscous drag, fluid acceleration, and buoyancy forces. For drag forces, the emphasis here is on the modeling of the pressure drag. Recent advances in underwater position and velocity sensing enable real-time centimeter-precision position measurements of underwater vehicles. With these advances in position sensing, our ability to precisely control the hovering and low-speed trajectory of an underwater vehicle is limited principally by our understanding of the vehicle's dynamics and the dynamics of the bladed thrusters commonly used to actuate dynamically positioned marine vehicles. So the dynamics of thrusters are developed and an appropriate mapping matrix dependent on the position and orientation of the thrusters on the vehicle is used to calculate resultant forces and moments of the thrusters on the center of gravity of the vehicle. It should be noted that hull-propeller and propeller-propeller interactions are considered in the modeling too. Finally, the results of the simulations, for an underwater vehicle equipped with 1 two degrees of freedom manipulator are presented and discussed in detail.

Lee, PM	Proceedings Paper	MOERI	2006	OCEANS 2006 - ASIA PACIFIC, VOLS 1 AND 2 : 742-+ 2006

Title: Navigation and control system of a deep-sea unmanned underwater vehicle 'HEMIRE'
Abstract: This paper presents a hybrid underwater navigation and control system for positioning, guidance and control of a deep-sea unmanned underwater vehicle (UUV), HEMIRE. For precise navigation of the UUV, the hybrid navigation system is designed based on strap-down IMU (inertial measurement unit) accompanying with USBL (Ultra-short base line), DVL (Doppler velocity log), range sonar, depth and heading sensors. Initial localization and position reference of the UUV are performed with the USBL when the vehicles are in stationary condition. This paper also presents the characteristics of the UUV and the system constitution of the surface control unit. HEMIRE is equipped with two hydraulic manipulators, ORION, which are remotely controlled at the surface vessel via fiber optic communication. An operator can control the manipulators with a workspace-controlled master arm as well as a parallel-type master arm. This paper describes the task-oriented control of the tele-operated robotic arms mounted on HEMIRE and its application to task-oriented joint configurations.

Jun, BH	Proceedings Paper	KORDI	2004	OCEANS '04 MTS/IEEE TECHNO-OCEAN '04, VOLS 1- 2, CONFERENCE PROCEEDINGS, VOLS. 1-4 : 1548-1553 2004

Title: Manipulability analysis of underwater robotic arms on ROV and application to task-oriented joint configuration
Abstract: This paper describes task-oriented manipulability of tele-operated robotic arms mounted on remotely operated vehicle (ROV) and its application to task-oriented joint configurations. Main purpose of the study is to reduce tele-operator's burden in performing underwater tasks by enhancing the functionality of manipulator. Even though a manipulator has 6 degrees-of-freedom (DOF), which is proper DOF to work in Cartesian workspace, the manipulator might have redundancy according to task types and order of task-priority. This paper focuses on the problem to utilize the redundancy by introducing a scalar function as an object of optimization. The scalar function is composed of task-oriented manipulability measure (TOMM) and joint limit measure (JLM). Using sequential quadratic programming (SQP) with the object function, we obtained optimal postures of manipulator for a given position constraint of end-effecter. Adopting the scalar function as a performance index, we solve a redundancy resolution problem based on pseudo inverse of task-oriented Jacobian matrix.

Antonelli, G	Article	Univ Cassino	APR 2003	CONTROL ENGINEERING PRACTICE 11 (4): 445-452 APR 2003

Title: A fuzzy approach to redundancy resolution for underwater vehicle-manipulator systems
Abstract: The problem of redundancy resolution and motion coordination between the vehicle and the manipulator in underwater vehicle-

manipulator systems (UVMSs) is addressed in this paper. UVMSs usually possess more degree of freedom than those required to perform end-effector tasks; therefore, they are redundant system and kinematic control techniques can be applied aimed at achieving additional control objectives besides tracking of the end-effector trajectory. In this paper, a task-priority inverse kinematics approach to redundancy resolution is merged with a fuzzy technique to manage the vehicle-arm coordination. The fuzzy technique is used both to distribute the motion between vehicle and manipulator and to handle multiple secondary tasks. A numerical case study is developed to demonstrate effectiveness of the proposed technique. (C) 2003 Elsevier Science Ltd. All rights reserved.				
Pillai, PRS	Proceedings Paper	-	2003	OCEANS 2003 MTS/IEEE: CELEBRATING THE PAST...TEAMING TOWARD THE FUTURE : 355-355 2003
Title: Design and development of a remotely operated underwater multi-robot manipulator controller **Abstract:** -				
Marchand, E	Article	INRIA Rennes	JUL 2002	INTERNATIONAL JOURNAL OF ROBOTICS RESEARCH 21 (7): 635-647 JUL 2002
Title: Controlling an uninstrumented manipulator by visual servoing **Abstract:** In this paper we present a method to control the displacement of a robot arm with no proprioceptive sensor. The joint positions are not available and this manipulator is usually open-loop controlled. In order to get a more efficient control interface, we propose a closed-loop system based on an eye-to-hand visual servoing approach. We show that, using such an approach, measurement of the manipulator motion with proprioceptive sensors is not required to precisely control the end-effector motion. We propose solutions for position-based control and velocity control of the manipulator. To maintain. the end effector in the camera field of view, the camera orientation is also controlled. Various results show the validity and the efficiency of the approach.				
Carignan, CR	Article	Univ Maryland	AUG 2001	IEEE TRANSACTIONS ON SYSTEMS MAN AND CYBERNETICS PART C-APPLICATIONS AND REVIEWS 31 (3): 327-336 AUG 2001
Title: Control architecture and operator interface for a free-flying robotic vehicle **Abstract:** Space and underwater vehicles with robotic arms can severely tax the capability of conventional control systems. Submersible vehicles used in neutral buoyancy simulation are subject to even greater demands since they must simulate the dynamics of spacecraft on orbit as well as function as a remotely-operated underwater vehicle. In this report, the onboard control architecture, human-machine interface, and vehicle/operator communications are described for one such vehicle in operation at the University of Maryland Neutral Buoyancy Research Facility (NBRF). The Ranger Neutral Buoyancy Vehicle (RNBV) exemplifies the high-dimensional, computationally intensive nature of the current fleet of autonomous underwater vehicles while its complement of four manipulators exceeds the capabilities of most remotely operated vehicles in service today. The sensor-based, embedded onboard control system is described, and its implementation using multiple control stations is discussed.				
Marchand, T	Proceedings Paper	IRISA	2001	OCEANS 2001 MTS/IEEE: AN OCEAN ODYSSEY, VOLS 1-4, CONFERENCE PROCEEDINGS : 1047-1053 2001
Title: Controlling an uninstrumented ROV manipulator by visual servoing **Abstract:** In this paper we present a vision-based method to control the displacement of robot arm mounted on an underwater ROV. A closed-loop system based on an eye-to-hand visual servoing approach has been designed to achieve this task. We show that, using such an approach, measuring the manipulator motion with proprioceptive sensors is not required to precisely control the end-effector motion.				

To maintain the end effector in the field of view, the camera orientation is also controlled. Presented results show the validity of the approach.				
Marchand, E	Proceedings Paper	Inst Natl Rech Informat & Automat	2001	2001 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION, VOLS I-IV, PROCEEDINGS : 2773-2778 2001
Title: Controlling the manipulator of an underwater ROV using a coarse calibrated pan/tilt camera **Abstract:** In this paper we present a vision-based method to control the displacement of robot ann mounted on an underwater ROV A closed-loop system based on an eye-to-hand visual servoing approach has been designed to achieve this task. We show that, using such an approach, measuring the manipulator motion with proprioceptive sensors is not required to precisely control the end-effector motion. To maintain the end effector in the field of view, the camera orientation is also controlled. Presented results show the validity of the approach.				
Heney, PJ	Article	-	NOV 2000	HYDRAULICS & PNEUMATICS 53 (11): 31-+ NOV 2000
Title: Forestry equipment strikes fear into trees **Abstract:** -				
Simon, D	Article	Inst Natl Rech Informat & Automat Sophia Anitpoli	OCT 1998	INTERNATIONAL JOURNAL OF SYSTEMS SCIENCE 29 (10): 1081-1098 OCT 1998
Title: Control laws, tasks and procedures with ORCCAD: application to the control of an underwater arm **Abstract:** Software reliability is a major issue in the design of control architecture for robots operating in hostile or poorly known environments. The ORCCAD control architecture gathers control laws in continuous time at low levels and logical aspects in discrete time at higher levels. While some performances can be checked using simulations, crucial properties such as dead-lock avoidance, safety mid liveness can be formally verified at both levels, using in particular some advantages of synchronous programming and associated tools. In the framework of the Union project, the underlying programming style using mission composition of the basic actions and formal verification is illustrated by the design of an underwater structure inspection mission simulation using a remotely operated vehicle fitted with a manipulator. Since the physical system is not yet ready, only realistic simulation, results are provided, but it is expected that they: will be rather easy to transfer to the real plant.				
Lapierre, L	Proceedings Paper	LIRMM	1998	OCEANS'98 - CONFERENCE PROCEEDINGS, VOLS 1-3 : 931-935 1998
Title: Hybrid position/force control of a ROV with a manipulator **Abstract:** A new control method to improve the behaviour of a ROV platform equipped with a manipulator has been developed. The torque produced by the arm on the platform is estimated with a force sensor installed on the joint between the manipulator and the vehicle. This allows to correct the position errors of the platform using a force control loop included in the position control loop. This paper describes the principles of this control method (Part II), the simulator which has been developed to test it (Part III), and the simulation results (Part IV).				

RELATÓRIO DE BUSCA PARA AVALIAÇÃO DE ANTERIORIDADE DE TECNOLOGIA

Pesquisa em documentos de patentes e literatura científica

Schebor, FS	Proceedings Paper	INNOVAT ASSOCIATES INC	1995	TELEMANIPULATOR AND TELEPRESENCE TECHNOLOGIES II 2590: 23-32 1995
Title: A virtual environment for undersea telepresence **Abstract:** -				
Broome, D	Proceedings Paper	TECH SOFTWARE CONSULTANTS LTD	1995	OCEANS '95 MTS/IEEE - CHALLENGES OF OUR CHANGING GLOBAL ENVIRONMENT, CONFERENCE PROCEEDINGS, VOLS 1-3 : 1216-1224 1995
Title: Subsea weld inspection using an advanced robotic manipulator **Abstract:** -				
McLain, TW	Proceedings Paper	STANFORD UNIV	1995	OCEANS '95 MTS/IEEE - CHALLENGES OF OUR CHANGING GLOBAL ENVIRONMENT, CONFERENCE PROCEEDINGS, VOLS 1-3 : 1208-1215 1995
Title: Experiments in the coordination of underwater manipulator and vehicle control **Abstract:** -				
Boyle, BG	Article	-	1995	TRANSACTIONS OF THE INSTITUTE OF MEASUREMENT AND CONTROL 17 (5): 242-250 1995
Title: Concept evaluation trials of teleoperation system for control of an underwater robotic arm by graphical simulation techniques **Abstract:** In the main, the current control method for underwater manipulators involves a master-slave robot configuration combined with visual feedback provided by closed-circuit TV from a number of ROV mounted cameras. In order to overcome the various drawbacks of this system, a new method of both control and feedback, utilising simulation software developed for off-line programming, is currently under development at Cranfield. This paper describes these new methods, and summarises the need for them and their inherent advantages over current technology. It also includes a description of the first stages of their development and the evaluation experiments which were used to judge the feasibility of the continuance of the project.				
LARKUM, T	Proceedings Paper	TECH SOFTWARE CONSULTANTS LTD	1994	PROCEEDINGS OF THE THIRD IEEE CONFERENCE ON CONTROL APPLICATIONS, VOLS 1-3 : 1081-1086 1994
Title: ADVANCED CONTROLLER FOR AN UNDERWATER MANIPULATOR **Abstract:** -				
LANE, DM	Proceedings Paper	-	1991	INTERNATIONAL CONFERENCE ON CONTROL 91, VOLS 1 AND 2 332: 493-498 1991
Title: PLANNING AND CONTROL FOR COORDINATION OF UNDERWATER MANIPULATORS **Abstract:** -				