School of Mathematics, Computer Science & Engineering

Academic excellence for business and the professions

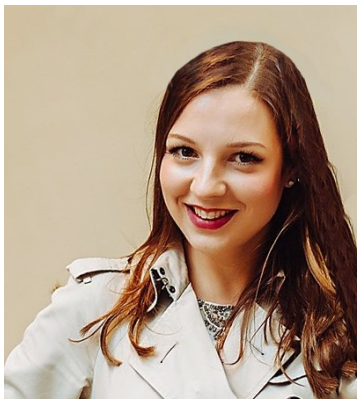
Making Waves

Newsletter for Maritime Studies Students and Graduates

No. 7 December 2017

Ship Efficiency the Way Ahead

Some 95 percent of the global cargo is moved by sea (Clarkson Research). While shipping is the most carbon efficient mode of commercial transport, total emissions are still comparable to some major national economies. The IMO Marine Environment Protection Committee (MEPC) adopted mandatory measures to reduce Green House Gas (GHG) emissions from international shipping through amendments to MARPOL Annex VI Regulations. These amendments include the application of the Energy Efficiency Design Index (EEDI) for new ships. Ship efficiency is central to satisfying the EEDI threshold, and reducing GHG emissions and can be impacted by instalments of energy saving devices, alternative machinery arrangements and fuels as well as by looking at the vessels operational profile.



Dr Elena Hauerhof

The aim of Elena Hauerhof's PhD research was to develop an advanced understanding of the necessary and realistic performance expectations from a full form medium size ship system by means of numerical computer modelling. The question was how to minimise the harmful environmental signature in compliance with the EEDI requirements, and enhance the EEDI methodology to achieve this.

The investigation focused on a medium sized products tanker (as a midpoint of the spectrum of ship sizes within the range of 20,000 – 60,000 DWT of this type), and has:

- Produced a structured analysis of energy efficient technologies market.
- Identified the most favourable fuel consumption reduction methods for this type of ship.
- Developed an integrated computer simulation model, which links engine, propeller and hull analysis programs, and
- Calibrated this model with model tests and sea trial data.

The ship system has been analysed under diverse conditions including various propulsion systems, innovative machinery arrangements, efficiency-enhancing hydrodynamic appendages as well as changing weather and load conditions.

The evaluation of potential benefits proceeded by comparing the four designated Energy Efficiency Indicators, namely, (1) the propulsive efficiency; (2) fuel oil consumption; (3) exhaust emissions footprint; and (4) EEDI respectively associated with the technical, fuel savings, environmental and legal perspectives. (*Continued on page 2*)

Contents

Union Maritime Limited, Internship Opportunities

Current and recent students in London and Piraeus are reminded of the Union Maritime Internship Scheme. Each year the company offers two competitive internships of 12 weeks duration to maritime students from City, University of London. Upon successful completion of the internship the company may offer the internees full time employment. **Admission to the scheme is by competitive interview and expressions of interest in the scheme should, in the first place, be made to Professor Carlton.**

Real Time Graduates: Apply for Internships and Work Experience

The Real Time Graduate scheme aims to provide internships and work experience placements in shipping organisations for students under the age of 30, with an undergraduate or postgraduate degree in shipping and maritime studies. Both London and Piraeus based students of the Maritime Operations and Management programme may apply.

Please Contact: Jenny Christodoulou info@investinthefuture.gr or Efi Smyrlaki at projects@investinthefuture.gr

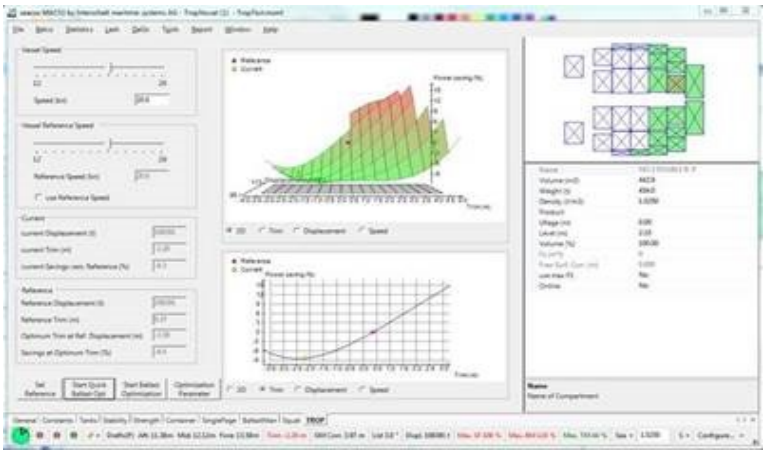
(*Continued from page 1*)

Ship Efficiency the Way Ahead

This work has contributed to detecting a number of uncertainties in the current EEDI formulation while pointing out ways in which it can be improved.

The thesis results concluded that a medium size ship system may benefit from:

- the installation of a CLT propeller in combination with the wake equalizing duct;
- a maximised propeller diameter with reduced rotational speed for new build application;
- careful trim optimisation, by means of on-board computer simulations, will help to maximise the hull design beneficial features and most likely result in fuel savings;
- the minimisation of the propeller's blade area ratio (should the cavitation resistant propeller materials or coatings be introduced to the market);
- the continuous operation at the most optimum load by means of load levelling concepts will bring significant reductions in emissions and fuel consumption as well as stabilised engine exploitation.



Example of on-board trim optimisation software. "The maritime-shipping industry has been forced to contend with the key issues of energy efficiency and sustainability. Optimizing the trim of a ship is a good way to achieve lasting reductions in fuel consumption. " ***INTERSCHALT maritime systems AG presents its new fuel saving TROP trim optimization software.***

For **Energy Efficiency Design Index** specifically:

- to include on-board trim optimisation software as a mandatory requirement for a successful EEDI certification.
- to employ the attained EEDI, based on the potential vessel behaviour at representative weather conditions associated with Beaufort scale 3.

Dr Elena Hauerhof says that "the knowledge I've gained during my PhD has led into further related work including the development of BetterFleet operational index methodology, and contribution to the estimation of the UK related emissions from shipping for the National Atmospheric Emissions Inventory (NAEI) and the Greenhouse Gas Inventory (GHGI) for Department for Business, Energy & Industrial Strategy (the official report is to be out in January 2018). I now work for UMAS a UCL based Maritime Consultancy. ". Thesis Link.

Contact email: elena.hauerhof@i-mas.co.uk

City, University of London υποστηρίζει την εκπαιδευτική πρωτοβουλία Isalos.net

Gathering of AEN students outside events centre in Chania Crete

- 1st event of Isalos.net took place on Saturday 4th November at the Museum Benaki.
- 2nd event took place on the Friday 1st of December in Chania Crete.
- 3rd event 18th December in Piraeus at Aikaterinis Laskaridis Foundation.

From Press release: Isalos.net events are in collaboration with Real Time Graduates and sponsored by the Naftika Chronika, the 1st event attracted the interest and active participation of 450 students and officers of the National Committee. The 2nd event: attracted intense interest and enthusiastic participation of 530 students." isalos.net

Speakers and contributors included the Minister of Shipping and Island Policy, Mr. Panagiotis Kourouplis, the 1st Chief of Staff of the Coast Guard, Vice Admiral Theodoros Kliaris, the President of Intercargo, Mr. Ioannis Platsidakis , as well as the president of MARTECMA, Stavros Chatzigrigoris.

Ms Marilena Kokonaki discussing our course at the City, University of London exhibition stand.

In the specially designed area, 53 representatives of shipping companies, mutual societies and educational institutions had the opportunity to discuss and explore employment prospects for the young and new entrants. The events included thematic panels with expert rapporteurs expressing their views on topical issues concerning new bridge and engine technology and onboard safety while answering numerous questions from the highly active and interested public.

For more information on studying for a City, University of London accredited Masters in Maritime Operations and Management in Greece click here.

July 2017 Graduation Day at the Barbican

Graduates 2015-17

Master of Science in Maritime Operations and Management (Greece)

Panagiotis Boutos

Andreas Demetriou

Loukas Stamellos

Sofia Stropeli

Panagiotis-Vyron Tsournos

Miss Sofia Stropeli and Mr Panagiotis-Vyron Tsournos after the graduation.

Archive videos of the ceremony on Tuesday 18th July 2017 click on the image.

Sofia Stropeli said: " Professor Carlton was so proud of our success. Attending the ceremony at the Barbican with my family was one of happiest day of the year. The funny part is I did not want to take off my gown!"

Sofia goes on: " I stayed in London for a week and it was a great opportunity to combine a vacation with graduation. My family and I had a chance to meet Professor Carlton at the University. He gave us a tour and narrated facts abut the history of the University. It was wonderful that he spent time with us even though he was busy. I am looking forward to the future with knowledge and skills that give me confidence to go forward with my career in the maritime industries. "

A Voyage of Discovery Bags the HCMM Student of the Year Award

Learning is a strange thing. There is no knowing where it can take you—but what happens when you start with an undergraduate degree in Law and then become interested in the science of marine invasive species and climate change? Our students, like Nicola Asprou travel great distances across disciplines. Read Nicola Asprou's profile, and her dissertation abstract. Nicola won the Honourable Company of Master Mariners (HCMM) student of the Year award (2015/16), and graduated with a distinction.

Nicola Asprou is presented with the Student of the Year certificate and a cheque for £500 by the current Master of the HCMM Captain F. K. D'Souza. The award ceremony took place on board the HQS Wellington.

PROFILE. In October 2015 Nicola Asprou wrote: "I am currently enrolled at City University London, undertaking the Maritime Operations and Management MSc after completing the LLB law. My interest in the maritime industry arose after I did maritime law during my bachelor's degree. I found it extremely interesting but did not intend to pursue a career in law. Therefore, I searched for alternative career opportunities in the maritime industry. This master's course is covering various sectors within the industry. Considering that my knowledge of it is limited, it provides numerous choices as to which field to get into after completion of the course. I love travelling, learning new languages and experiencing different cultures and I wish to pursue a career that would offer this lifestyle. My main aim at this point is to excel in this course, take away as much as possible and make a career choice that will prove wise in the future. "

DISSERTATION ABSTRACT. Title: Response of marine invasive species to climate change from a UK perspective

Climate change is an emergent issue of considerable concern throughout the world. Due to several climate conditions including sea temperature rise and increased CO_2 intake amongst others, several marine species can no longer survive in their natural habitats. To make matters worse, these climate changes can facilitate marine invasive species expansion in areas not previously accessible with reduced competition. This paper discusses the history of marine invasive species alongside the vectors of spread by which they have been introduced in host environments around the world. The research then focuses on the impact of some notorious marine invasive species on the United Kingdom's ecosystem and economy. The literature analysis, focuses on climate change and examines the effect it can have on the introduction and establishment of marine invasive species in UK and Irish waters. Expert opinions are further employed to include relevant fieldwork and studies undertaken in several monitoring sites across the UK. The findings suggest that climate change will act in conjunction with human-induced stressors and the impact on habitat structure and composition will be related to both mechanisms. The same principle is applied to invasive species. Furthermore, a number of invasive species have been identified that pose a significant risk to the UK ecosystem. Overall, climate change is a continuous issue and further impacts remain to be seen.

2017-18 Cohorts First Week in London and Piraeus Greece

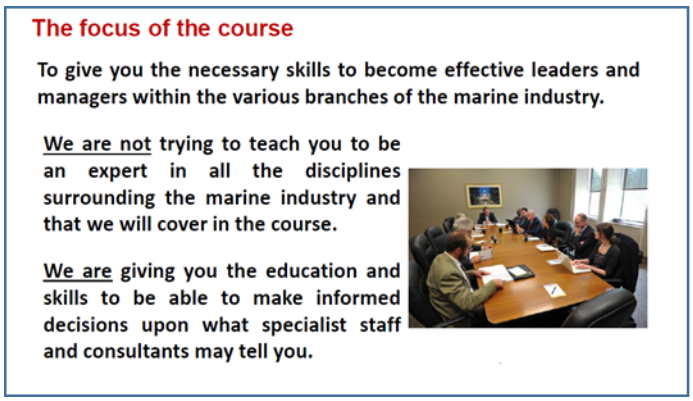
Welcome to the London Class of 2017-18, some of whom are photographed outside the Franklin Building which is part of City, University of London

View from the window London and Piraeus.

Welcome to Class of 2017-2019 in Greece , In the Hellenic Lloyds Register Training Centre Piraeus

Piraeus hospitality and networking after Induction

CityLibrary



Slides from Professor John Carlton's Induction presentation in London and Piraeus

Looking Back HQS Wellington on the Thames

The 2016-17 cohort has come to the end of their time at City, University of London. We look back at the midpoint of the Programme with photos from the annual programme dinner on board the HQS Wellington the livery hall of the *Honourable Company of Master Mariners.* Where was dinner served? *In the engine room of course*!

On the stairs leading to the engine room on board the HQS Wellington.

On the deck of the HQS Wellington . Cold April sky with the London Eye in the background.

Master of Science in Coastal and Marine Engineering and Management (CoMEM)

The Erasmus+: Erasmus Mundus MSc in Coastal and Marine Engineering and Management is an integrated programme including mobility organized by five European partner institutions, coordinated by the Norwegian University of Science and Technology (NTNU).

Encarnación I López Castejón

The CoMEM students that chose City, University of London for their 2nd year of study were featured in *Making Waves March 2017* . Encarnación I López Castejón was one of those students. In 2017 Encarnación's dissertation was commended by the examiners and she will graduate with MSc (Distinction). Here is the abstract of her dissertation.

Analysis of the Influence of the Verified Gross Mass Regulations in the Container Terminal Yard Operations

Containerisation has developed to become the current standard means to transport general cargo, and its growth is parallel to the development of specialized facilities to handle them - Container Terminals. For their nodal role in container transportation, such facilities are subject to Safety and Security (S&S) issues e.g. relating to overweighed containers. In this context, the Verified Gross Mass (VGM) emerges as the most recent (2016) regulation concerning S&S in container shipping, controlling container weight declaration.

The research in this dissertation conducted an IDEF3 modelling of the processes that take place in a generic Container Terminal, focusing on the Container Yard operations in the inbound flow, considering the most common types of container and yard configurations. Such processes are analysed, identifying and evaluating the presence of VGM related processes, and the impact they pose in the overall operation.

This model is evaluated through a Generic case of a Container Terminal, for each of the proposed configurations and container types. The results obtained highlighted that, from a Terminal Operators' point of view, the influence of VGM regulations is focused on the operation of the *Full Container Load (FCL)* general containers, and especially in the cases where integration systems were not implemented within the yard equipment. In these cases, the time of operation in the VGM- related processes could reach up to 45% of the total operating time in the Yard Area.

From these results, and in a scenario where container weighing starts to be a demand for most operators, there is an emerging need for them to install weighing systems within the Terminal facilities. However, the way such systems are implemented should be carefully considered due to their potential relevance in the operation, which is mostly dependent on the traffic demands. To enhance this process two recommendations are offered: (1) expansion of the integrated implementation in order to certify VGM of containers to a greater variety of different types of Yard equipment than is currently the case; and (2) an analysis of the whole supply chain which could enhance trust between the different stakeholders, ensure VGM compliance, and improve overall efficiency avoiding redundancies in the weighing procedures.

A grain of sand on a beach of knowledge. Show casing the diversity of student dissertations.

3D Spare Part Printing on board vessels: Is it feasible and economical? By Fatih Onder

Fatih Onder

During the past decade, 3D printing has quickly developed into a vital interest for technological innovators, heavy industry manufacturers and notably, the maritime industry. General Electric has previously printed fuel nozzles and SIEMENS has pioneered the printing of gas turbine blades for aircraft. It seems that 3D printing has the potential to dominate the future of the global 'spare part market'.

The research began with a review of the major maritime 3D printing projects. The Port of Rotterdam has established the Rotterdam Additive Manufacturing Laboratory (RamLab) where they have carried out 3D marine spare part printing pilot project. Maersk Tankers have worked on installing plastic polymer 3D printers on board their vessels to solve spare part problems for the ships that carry out cargo operations off-shore. In addition, United States Navy have initiated an acquisition programme to install 3D printers on board their navy vessels. A systematic SWOT analysis examined the challenges of implementing the use of 3D printing on board sea-borne vessels.

The output of this research is new visionary statement, which will help to address the logistics and transportation of spare parts by using a 3D printer while they are steaming in the middle of an ocean. This has to follow designated regulations and approved standards without causing any danger for the operator, or crewmembers' lives, the ship, the ship's equipment and both internal and external environments. Ultimately this analysis suggests significant opportunity for all shipping companies to save a substantial amount of revenue. The dissertation concludes with a discussion of the findings and the implications.

Impact of the Ballast Water Convention on Greek shipowners; Will they be scrapping more tonnage? By Apostolia Thanasou

Apostolia Thanasou

As a result of the rapid growth of international maritime trade, the marine environment has been imperiled with the transportation of invasive alien species by the ballast water of vessels. To address this problem and protect the ecosystem the IMO has developed and established the Ballast Water Management (BWM) Convention . The Convention stipulated a transitional period when vessels can conduct a Ballast Water Exchange, but after that all vessels must install a Ballast Water Management System. These systems must be approved by the IMO, and by national legislations where countries (e.g. USA) have developed their own regulations. Investing in these systems can be a great burden on shipowners and so they might scrap older vessels sooner than might otherwise be the case.

This project focuses on the implications of the BWM Convention on the scrapping industry. Choosing a BWMS can be frustrating for shipowners as they must examine many key factors, while a principal concern is whether the installation costs will be recovered before the end of ship's life. The investigation conducted interviews with shipowners and analysed the treatment systems to characterise the challenges faced by shipowners. The analysis considered the possible implications on the market. The main conclusion is that many ship owners are finding alternative solutions and delaying the installation of BWMS – it seems that expenditure cannot be justified for most of the vessels especially due to the current unfavourable market conditions.

A legal analysis of 'safe berth/port' warranty in charter parties and its impact on commercial activity of ship operators. By Dagmara Caluzinska

Dagmara Caluzinska

Over the centuries international maritime law has evolved to accommodate new challenges thrown up by successive technological revolutions and the influence of this on ship and port design.

For years ships have been employed with the contracts called charterparties. These contracts determine the duties and obligations both of the shipowner and the charterer. One of the integral clauses of the charterparties is the "safe berth/port" warranty. It gives the shipowner a guarantee that ports/berths nominated for the vessel's employment are safe for the particular vessel in trade. The classic definition of the 'safe port' can be found in the ruling of Sellers LJ in The "Eastern City" (1958)1. However, recently the interpretation of this has raised a controversy, when the first instance judgement of case of The "Ocean Victory" (2014)2 was overruled.

The focus of the research in this dissertation, is to identify how the interpretation of the 'safe berth/port' warranty has varied in different situations. Also the research elucidates how the change of understanding of how the 'safe berth/port' warranty can affect the shipowners' commercial activity. A case study of a Chilean Port is used to examine this problem and provides a basis for the conclusions and recommendations to shipowners, who may encounter disputes with claims related to safe berth/port warranty.

Notes on teaching the inquiry process by Dr Uma Patel

Readers browsing this issue of *Making Waves* will have noticed that we have included a number of edited abstracts from student dissertations and that these are interestingly diverse.

- Nicola Asprou's work draws on findings from biology and natural sciences (page 4)
- Encarnación I López Castejón turns to complex systems modelling (page 7)
- Fatih Onder investigates the viability of new 3D printing technology (Page 8)
- Apostolia Thanasou looks at economic constraints on operational change (Page 8)
- Dagmara Caluzinska explores interpretations of contract law in a challenging case study (Page 8)

The Maritime MSc courses at City, University of London draw on multiple disciplines. The wider field of vision generated by multidisciplinary approaches to teaching and research are often advanced as appropriate ways of addressing the complexity of the contemporary global world (Griffiths, 2014). When it comes to teaching our students to judge the quality of research, including their own, we want to teach principles which are general enough to accommodate disciplinary differences without compromising on quality (Mårtensson *et al*., 2016). The work showcased in this issue are a testament to how this is possible.

Before starting their dissertation research, our maritime students have to defend their plan in an extended research proposal that is convincing in addressing three questions:

- ***What*** is the topic. This is about framing the topic so that experts in the field will recognise it as relevant. In other words there is a body of published peer reviewed literature on the topic and it is an active field of research.
- ***Why*** is it important. This is about showing that the problem is important and why it matters in that field.
- ***How*** will you go about finding useful answers. This is about showing validity by designing the inquiry process to find useful answers within the time and resources. There are always limitations, but the investigation process has to be transparent and defendable.

Our students examine peer reviewed published research that combines: (1) methods in a transparent way; (2) arrive at reasonable results that can be robustly defended, (3) recognises limitations. In this way a principled inquiry can emerge from an organic process in which the students are encouraged to come up with *the what, why and how*. It is an approach to teaching the inquiry process that works with the diversity of multiple-disciplines.

Students study Cavitation as a topic in the Martine Technology module. The cavitation articles in this issue presents the *what, how and why* of this important research topic.

Mårtensson, P., Fors, U., Wallin, S.-B., Zander, U., & Nilsson, G. H. (2016). Evaluating research: A multidisciplinary approach to assessing research practice and quality. *Research Policy*, *45*(3), 593–603. Link

Griffiths, A. (2014). Multi-discipline courses will help solve emerging global problems. The Conversation. Online Accessed 1 Nov.2017) Link

Cavitation erosion fracture mechanisms and their detection in ship operation

Ioannis Armakolas writes

Ioannis Armakolas

My PhD research is concerned with the evaluation of the phenomenon of cavitation erosion in relation to some common shipbuilding materials such as structural steel, stainless steel and cupronickel. In addition to those materials, the behaviour of some protective coatings, in relation to cavitation erosion, is also explored.

The phenomenon is explored both quantitatively and qualitatively thus procedures such as mass loss and acoustic emission measurements as well as microscopic observations are utilized. Further to the aforementioned procedures, a cavitation erosion monitoring system for ship rudders, based on acoustic emissions, is also under development. Results from tests conducted on model rudders have been particularly encouraging, thus full scale testing is planned for the near future.

See also Armakolas, I., Carlton, J., Vidakovic, M., Sun, T., & Grattan, K. T. V. (2017). 'Cavitation erosion fracture mechanisms and their detection in ship operation.' *Proceedings of the Fifth International Symposium on Marine Propulsors*, *1*(June). Link

The Detection of Cavitation Erosion in Ship Operation

Ioannis Armakolas

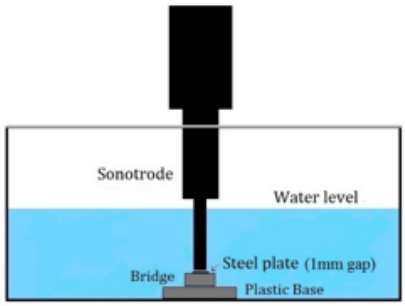
Presented at the 10th International Conference on Compressors and their Systems 2017

Introduction

This study is concerned with the phenomenon of cavitation erosion in relation to some common shipbuilding materials. The detection of cavitation erosion in ship operation is also considered.

Methodology

Cavitation was induced by ultrasonic means and as such an appropriate test rig was design and built, to accommodate both the ultrasonic transducer and the specimens to be examined.

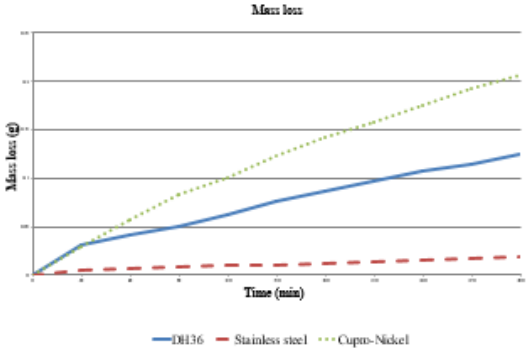


Experimental test rig

The small square specimens were placed on the bottom of a water tank while the transducer head – sonotrode was mounted just above their upper surface at a predetermined distance. The UIP1000hd ultrasonic transducer by Hielscher was used in this study, characterized by an adjustable power output, up to 1000W. The tip of the ultrasonic transducer (sonotrode) oscillates at a frequency of 19.5 kHz, thus it generates cavitation by means of inducing rapid pressure fluctuations in the surrounding liquid – water. A series of quantitative and qualitative measurements – observations were then conducted.

Mass Loss Measurements

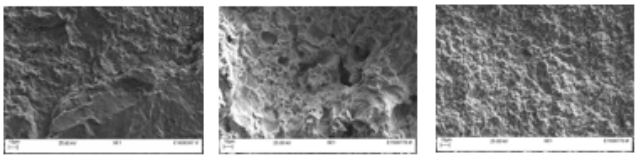
Specimens made from some common shipbuilding materials such as grade DH36 steel, stainless steel 254 and cupronickel 70-30, were initially exposed to ultrasonically induced cavitation for a period of five hours. Mass loss measurements were taken every thirty minutes and results were plotted onto a comparison graph. As such the progression of mass loss –erosion could then be evaluated.



Mass loss progression

Fractography

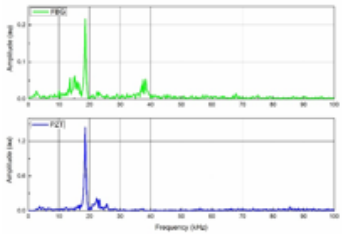
Further to mass loss measurements, specimens were also examined by means of a scanning electron microscope, in order for the fractography of erosion to be explored and characterized.



From left to right: Grade DH36 steel, cupronickel 70-30, stainless steel 254

Acoustic emissions

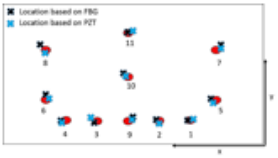
The use of acoustic emissions as means of erosion monitoring was also explored. Both piezoelectric and optical – fibre Bragg grating sensors were utilized and proved to be capable of detecting ultrasonically induced cavitation erosion by means of the dominant 19.5 kHz frequency component.



Frequency response spectra through the 0-100 kHz range. Top – Fibre Bragg grating, Bottom – Piezoelectric element.

Detection of cavitation erosion on a half – rudder model

The proposed method was also applied in the case of a half – rudder model. In addition to the aforementioned qualitative and quantitative procedures, the principle of triangulation was also utilized, for cavitation erosion localization purposes.



Surface of half rudder model. Red dots represent the real location of the sonotrode

Conclusions

Ultrasonically induced cavitation erosion was effectively characterized by means of a series of quantitative and qualitative procedures. Moreover, good correlation was achieved in the sense that observations and measurements could effectively be explained in relation to each other. Further to small specimens the method was also successfully applied on a half – rudder model, with the addition of a common triangulation technique for erosion localization purposes.

Cavitation the Birth of a Research Field

By Professor John Carlton FREng

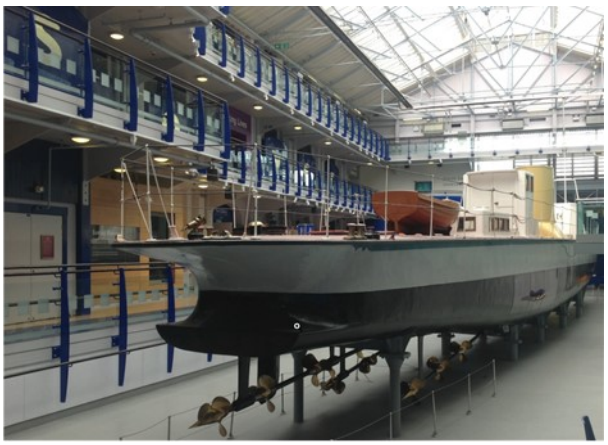
Cavitation is a general fluid mechanics phenomenon that can occur whenever a liquid is used in a machine which induces pressure and velocity fluctuations in the fluid. Consequently, pumps, turbines, propellers, diesel engine injectors, bearings and even the human body, in for example the heart and knee joints, are all examples of machines where the destructive consequences of cavitation may occur. While cavitation sometimes has undesirable consequences, this is not always the case, for example, in situations such as drug delivery, the cutting of rocks or steel plates.

The history of cavitation has been traced back to the middle of the eighteenth century, when some attention was paid to the subject by the Swiss mathematician Euler in a paper read to the Berlin Academy of Science and Arts in 1754. In that paper Euler discussed the possibility that a phenomenon that we would today call cavitation occurs on a particular design of water wheel and the influence this might have on its performance.

Small cavitation tunnel built by Sir Charles Parsons

However, little reference to cavitation pertaining directly to the marine industry has been found until the mid-nineteenth century, when Reynolds wrote a series of papers concerned with the causes of engine racing in screw propelled steamers. These papers introduced the subject of cavitation as we know it today by discussing the effect it had on the performance of the propeller: when extreme cases of cavitation occur, the shaft rotational speed is found to increase considerably from that expected from the normal power absorption relationships.

The trial reports of HMS Daring in 1894 noted this over-speeding characteristic, as did Sir Charles Parsons shortly afterwards, during the trials of his experimental steam turbine ship Turbinia. In order to understand why Turbinia would not perform satisfactorily, Sir Charles Parsons built the small cavitation tunnel shown in the picture. It was capable of testing 2 inch diameter propellers in a depressurised state to achieve the correct cavitation number. To study the cavitation formation over the blades, Parsons also introduced astrobostropic lighting arrangement to observe the propeller blades at particular angular settings. This showed severe thrust breakdown on the propeller blades due to cavitation and the need to either increase the blade area or, in this case, the number of propellers per shaft.



Turbinia on display at Newcastle Discovery Museum, 2013

The results of the various experiments carried out in these early investigations showed that an improvement in propeller performance could be brought about by an increase in blade surface area. In the case of the Turbinia, which originally had a single propeller on each shaft and initially only achieved just under twenty knots on trials, Sir Charles Parsons found that to absorb the full power required on each shaft it was necessary to adopt a triple propeller arrangement to increase the blade surface area to the required proportions to achieve an acceptable thrust loading. Consequently, he used three propellers mounted in tandem on each shaft, thereby deploying a total of nine propellers distributed over the three propeller shafts. This arrangement not only allowed the vessel to absorb the full power at the correct shaft speeds, but also permitted the quite remarkable trial speed of 32.75 knots to be attained. The outstanding performance of this little craft at the Spithead review in 1897 heralded the demise of reciprocating steam propulsion engines in Royal Navy.

More recently a series of very large cavitation facilities have been constructed in various locations around the world. Typical of these are the depressurized towing tank at MARIN in Ede; the large cavitation tunnel at SSPA in Gothenburg, and the HYCAT at HSVA in Hamburg.

WISTA: Women's International Shipping & Trading Association

By Valerie Stringer F.I.C.S.

The Review of Maritime Transport 2017, including the sub-chapter on gender issues click on the image to download

Formed in 1974, the Women's International Shipping & Trading Association (WISTA International) is a global organisation connecting female executives and decision makers around the world. WISTA International serves as a connector for its network of more than 3,000 female professionals from all sectors of the maritime industry.

More than 40 countries support a National WISTA Association (NWA), each of which in turn is a member of and is guided by WISTA International. NWAs provide in-country and regional networking, business and skill building opportunities, corporate visibility, and also facilitate relationships within the industry.

On a global scale, WISTA members have access to an incredibly diverse network of executives in the shipping and trading field on whom they can call for referrals, connections, advice or business collaborations.

Whilst studying in London, students can join for an annual subscription of £25, enabling them to attend events such as lectures relevant to the maritime industry, which also provides invaluable networking opportunities.

Pump power—Shoreham Port behind-the-scene

Maritime Operations and Management Students were given a behind-the-scene tour of Shoreham Port on a field trip organised by the module leader for Marketing of Maritime Services, - Valerie Stinger. The students were shown around by Tony Parker, director of engineering and Shoreham Port tour guide.

Field trip to Shoreham Port Facilities

He said "The sophisticated Track-a-Pack system keeping stock of 80,000 cubic metres of timber on the port, the carefully-managed quality control of grain for export, the sheer power of the pumps used to keep the water levels topped up and a myriad of other details are always a real eye-opener." The students visited sites including Brighton Terminal, the new warehouse on the outer layby, and the dry dock and pump house.

Valerie Stringer said, "I am grateful to Shoreham Port for facilitating this visit, particularly as it provides a classic example of the need to adapt to change and respond to supply and demand by diversifying from the traditional trades of the past, in order not just to survive, but to flourish. A big thank you to the port and Tony Parker for the tour."

Peter Cook writes about living in London and returning to Higher Education to prepare for the increasingly complex challenges facing maritime security professionals

Peter Cook

I had been a maritime security professional for 8 years, mainly focused on countering piracy off the coast of Somalia. Clearly there has been an exponential increase in volume of trade moving by sea, ever larger amounts of fossil fuels and base metals being extracted offshore and the criticality of port strategies to international supply chains. In recent years there has been an overall growth in maritime crime, an upward trend in the audacity of maritime terrorism and the global realisation and recognition of our reliance on the fragile ecosystems of the globe's oceans. Given these trends it was clear to me that maritime security was becoming increasing multifaceted and complex, and I therefore needed a more diverse knowledge base to remain commercially competitive.

For these reasons I enrolled on the MSc in Maritime Operations and Management as a part-time student. Every module so far has provided me with new knowledge and understanding that has opened opportunities and enriched the way I approach my work with the maritime industry.

I have developed a much better understanding of **maritime economics**, allowing me to better understand a ship owner's perspective when considering whether to re-route around a maritime security hot spot or not. In **maritime operations**, we studied in detail the purpose and application of the International Safety Management (ISM) Code. In June, this year, the International Maritime Organization (IMO) developed a resolution for the incorporation of maritime cyber risk management as part of the ISM code making it mandatory. This has opened a number of commercial opportunities for me with cyber security companies that don't comprehend the functional importance of the ISM Code to a burgeoning shipping client base.

The module on **port strategy** was fascinating and inspiring. It prompted me to ask questions about the commercial advantages for ports to improve their security arrangements against pilfering, stowaways, smuggling and terrorism as a research subject for my dissertation and whether a more secure port attracts more business. The module on **maritime security** introduced me to the concept of thinking about security for the entire supply chain rather than focusing on its discrete elements, which broadened my understanding and provoked me to review my approach to the genre of maritime security.

The work we did on **environmental studies** gave me a much clearer and deeper understanding of the importance of the oceanic ecosystem and its fragility. This has allowed me to initiate a collaborative relationship with a company involved in supporting sustainable fishing commercially as an element of a maritime security strategy.

The new challenge of writing academic essays has enhanced my English and developed my writing style, so that I now write short articles for several media publications, which is fun and stimulating.

As a mature student, mixing with younger international classmates has been an enriching and thoroughly enjoyable experience. It has also allowed me to share my love of my home city, London, and some of its wonderful pubs. I am really looking forward to the second part of my course at City.

Research and Programmes in Maritime Studies

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