

## The Integrated Maritime Education and Research Activity of Gdynia Maritime University for Seafarers

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**Abstract:** In this paper, authors describe maritime engineering and technology education, training and research in Poland based on the example of Gdynia Maritime University. The purpose of the paper is to present an integrated educational and training system for professional staff who are capable of meeting the current demands for maritime specialists of any description from ship-owners and shore-based companies of the sea economy. The integration involves the following: curricula, research projects and the development of scientific staff on the one hand and a course on seagoing services, as well as shore-based industrial experience of marine professionals on the other hand. The paper contains the goals and aims of the system, the profile of a graduate of a maritime university and the educational process that is effected through a multilevel structure of the system. The authors conclude by looking at issues that are connected with an improvement of the current system, the establishment of new lines of study, and the quality of the training process with regard to both safety at sea and the effectiveness of shipboard apprenticeship as each year, the world market demands more and better qualified professionals for ship operations, repairs and service.

**Keywords:** marine education and training, marine engineering fields and specializations, scientific maritime research

### 1. GENERAL EDUCATIONAL CONDITIONING

The present technical standards of ship equipment require a high level of competence and skills from a professional shipboard officer. This is because, within a predictable span of time, world trends in shipbuilding are set to generate even higher demands regarding the qualification standards of a ship's crewmembers.

Despite the present economically difficult situation in Poland, it is still possible – even necessary – to maintain the number of engineers and deck officers to be educated by Polish maritime schools, although a systematic reduction in the costs of their education has also become another necessity.

The following characteristics should be noted:

- The maritime engineering education process has been implemented in accordance with the Bologna Process embarked upon by the European Union (EU);
- University graduates, as a rule, first find their employment with state and private ship-owners in Poland, and then in the global maritime labour market;
- Maritime studies do not repeat, in any way, the study courses at universities or technical universities because of their specifically marine and operational nature;
- The present premises and teaching staff resources justify the maintenance of the usual number of candidates for studies within the 8 fields in 38 specializations, as well as an increase in the number of paying part-time candidates. Both factors have an essential impact on the reduction of unemployment and an increase in the spread of education in Poland.

The Polish maritime education has built a tradition for the past 91 years, and maritime schools have survived despite difficult periods in the history of the Polish sea economy [6].

## **2. THE MISSION AND STRATEGIC GOALS**

### ***2.1 Mission***

The mission of the Gdynia Maritime University (GMU) is to train marine officers for shipboard positions on merchant marine vessels and educate managers for positions at land-based enterprises of maritime industries in compliance with Polish, European and international educational standards by providing them with a solid basis for their professional careers where the awareness of global labour markets is harmonized with developments in the employment opportunities offered in Polish maritime regions, Poland and the EU.

### ***2.2 Strategic goals***

The strategic goals are as follows:

- Ensure that students are taught by high quality scientific and teaching academic staff;
- Obtain the rights to award PhD and DSc degrees by all faculties;
- Develop a three-stage Bologna system of studies by offering bachelor or engineer degrees (stage one), master of science degrees (stage two), and doctoral degree (stage three);
- Strengthen the specific maritime profile of the University by developing unique fields, minors and majors of study;
- Attain a balance in the number of students studying within the full-time and part-time systems, with a simultaneous development of postgraduate studies offering new professional opportunities;
- Enhance the development of scientific and teaching staff in those domains that constitute a specific maritime flavour of the GMU;
- Participate in the University's research teams in national, European and international research projects;
- Upgrade laboratory facilities and the quality standards of the University's premises;
- Develop cooperation with national, European and international universities seeking to upgrade educational standards and to undertake scientific research;

- Strengthen the links between the GMU and enterprises, self-government bodies, welfare organisations, as well as regional, national and international scientific and professional associations;
- Strengthen the role of the University as a world centre of maritime education and training.

### **3. PROFILE OF A GRADUATE OF MARITIME STUDIES**

A graduate of maritime studies at the university level is a highly educated specialist who is prepared to work onboard ships, for shore-based sea-oriented companies and the shipping industry. The professional competence of such a graduate may be described by the following characteristics:

- He/she holds the following professional degrees: BSc, Eng, MSc and science degrees - PhD, DSc and Title of Professor;
- Shipboard and shore-based workshop apprenticeship experience, as well as the qualifications that, when combined, make it possible for him/her to apply for a merchant fleet officer's certificate issued by the Polish Maritime Administration (PMA);
- Professional apprenticeship and qualifications to assume operational positions with a sea economy oriented and regional seaside enterprises.

The aim of the integrated system is to optimize the maritime education of professional staff for the needs of the sea economy, with very limited financial resources allocated by the State budget, on the basis of a curricula that is harmonized with the educational standards and requirements contained in the provisions of the International Maritime Organization (IMO), the Ministry of Science and Higher Education (MSHE), the State Accreditation Commission (SAC) and the International Standards Organization (ISO). The system is complemented by apprenticeship experience conducted on simulators and training ships and through wide cooperation with foreign maritime universities.

### **4. THE INTEGRATED MARITIME EDUCATION AND RESEARCH SYSTEM**

Polish maritime universities in Gdynia and Szczecin, apart from conducting their own curricula, have also assumed the role of coordinators in charge of the development and effectiveness of the integrated system of staff education for the sea economy under the authority of the Ministry of Infrastructure (MI) at the following four levels:

#### ***4.1 Secondary maritime education, supervised by the MI, covering:***

- Basic maritime education;
- Apprenticeship onboard training ships, and the supply of candidates to maritime academies that educate the teaching staff for these schools. Moreover, maritime post secondary schools have been established in response to the needs of the labour market. These schools are both private and state run and offer two-year education courses.

#### **4.2 Graduate studies:**

- Two-level, full-time studies in Gdynia that are free of charge;
- Two-levels, part-time, payable studies in Gdynia.

#### **4.3 Postgraduate studies:**

- Postgraduate courses in updating and completing knowledge in a particular specialization;
- Permanent postgraduate maritime training for shipboard officers at the operational and management levels.

#### **4.4 Doctoral and Habilitation studies that lead to:**

- The Doctoral studies (PhD);
- The Habilitation programme (DSc);
- The Title of Professor.

#### **4.5 Structure of the integrated system**

The structure of the integrated system is shown in Figure 1. The essence of the system is its effectiveness in the professional promotion - each level ensures the appropriate coverage of marine competence and performance (deck or engine rating, engineer, MSc, merchant fleet deck or engineer officer, doctor, associate professor and professor). Furthermore, the system enables students to obtain dual marine certificates (navigator-engineer, navigator-electronical engineer, navigator-electrician, engineer-electrician, etc) and also dual diplomas for academic teachers (professor - master mariner, professor - chief engineer, doctor - ship electrician, etc).

This system is based on the following:

- Education financed by the Ministry of Infrastructure (MI);
- Scientific research financed by the Ministry of Science and Higher Education (MSHE);
- International scientific and educational cooperation between maritime academic establishments under direct agreements or within such programme as *Live Long Learning Programme ERASMUS*.
- For example, from the academic year 2011/2012, Gdynia Maritime University will cooperate with 25 European universities, namely: Universidad de La Coruna (Spain), Universidad de Vigo (Spain), Universidad de Cadiz (Spain), Universitat Politecnica de Catalunya (Spain), Universidad de la Laguna (Spain), Universidad del Pais Vasco (Spain), Universidad de Extremadura (Spain), Universidad de Oviedo (Spain), Hochschule Bremerhaven (Germany), Fachhochschule Stralsund (Germany), Rheinisch-Westfaelische Technische Hochschule Aachen (Germany), Helmut-Schmidt Universitaet/Universitaet der Bundeswehr (Germany), Universita degli Studi del Sannio (Italy), Universita degli Studi di Perugia (Italy), Politecnico di Milano (Italy), Kymenlaakson Ammattikorkeakoulu (Finland), Cork Institute of Technology (Ireland), Stord/Haugesund University College (Norway), Lithuanian Maritime College (Lithuania), Latvian Maritime Academy (Latvia), Transilvania University of Brasov (Romania), Universite de Poitiers (France), University of Gavle (Sweden), Yasar University (Turkey), Universidade Tecnica de Lisboa (Portugal), under the *ERASMUS* programme for student and staff mobility in maritime studies;

- For many years, the GMU has been cooperating with over 30 esteemed and renown international maritime academies Europe, as well as in such diverse countries as the USA, Australia, China, Vietnam, Korea, Japan and Russia, to name a few;
- Student apprenticeship on training ships and ships owned by national and international carriers, as well as industrial apprenticeship with shipyards, ship-owner operations and manufacturing plants.

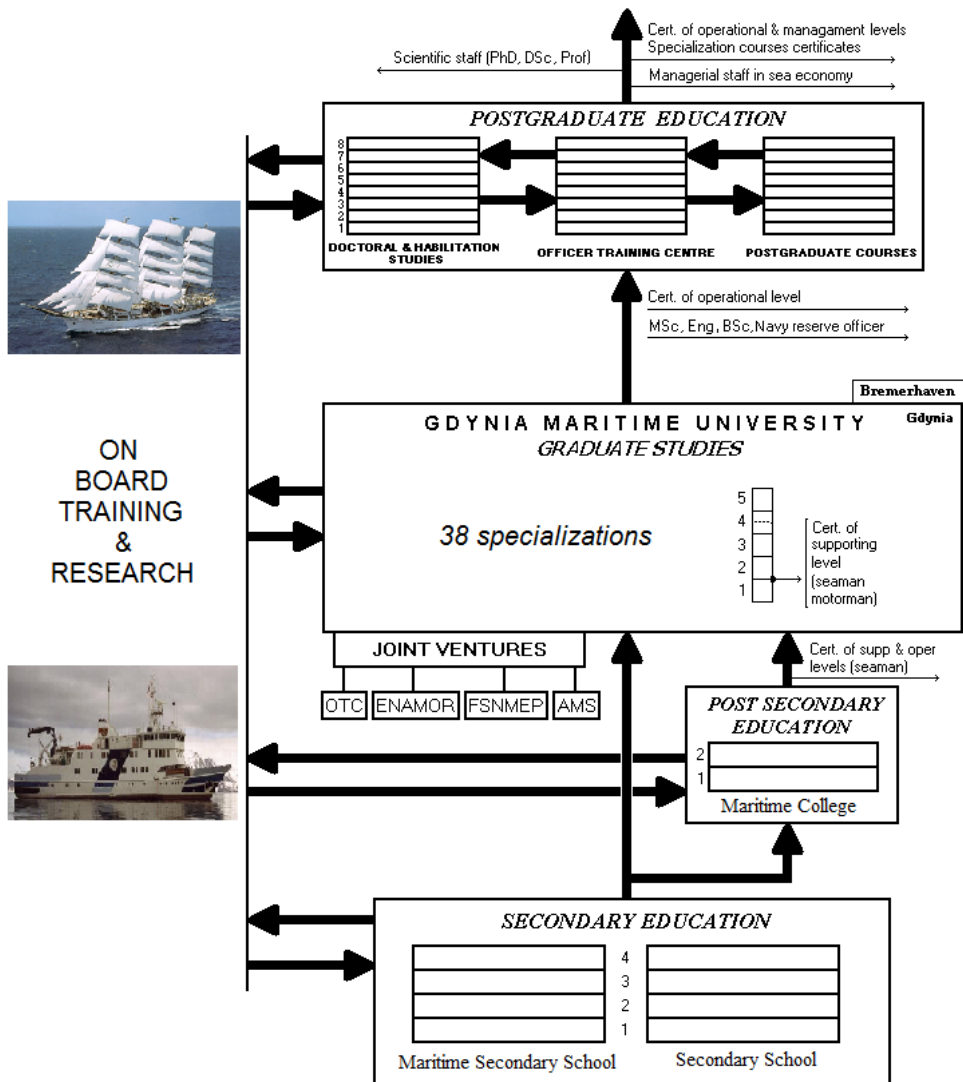


Figure 1. The structure of the integrated engineering maritime education and research system in the GMU.

## 5. INTERNATIONAL MARITIME REQUIREMENTS

The paramount objective of education in this area of maritime engineering is to convey required knowledge of the construction and operation of a ship's systems in accordance with the requirements of the International Maritime Organization (IMO) as formulated in the STCW 78/95 Convention.

The requirements concerning the officers have been distributed over three levels of competence:

- Supporting Level, concerning seaman and motorman certificates;
- Operational Level, concerning all shipboard officers;
- Management Level, concerning chief officers and masters.

Details are specified in the STCW Code separately for navigators and marine engineers in the form of *minimum standards of competence for officers in charge*.

## 6. MARITIME UNIVERSITY LEVEL EDUCATION

### 6.1 Graduate Studies

The higher education provided at Gdynia Maritime University is conducted in four faculties, 8 fields and in 38 specializations. These are described in more detail below.

The Faculty of Navigation conducts full-time and part-time studies in two fields, as follows:

- *Navigation (N)* with specializations in: Sea Transport (ST), Sea Traffic Engineering (STE), Marine Safety Systems (MSS), Offshore Technology (OT), Safety Transport Management (STM), Arctic Shipping (AS);
- *Transport (T)* with specializations in: Transport and Logistics (TL), Transport and Logistic Marine Systems (TLMS).

The Faculty of Marine Engineering carries out full-time and part-time studies in two fields:

- *Mechanics and Machine Building (MMB)* with specializations in: Marine Propulsion Plant Operation (MPO), Marine Propulsion Plant and Offshore Construction Operation (MPPOCO), Technology of Repairs of Ship and Port Units (TRSPU), Operation of Industrial Installations (OII), Operational Engineering (OE), Produce Engineering (PE), Repair Engineering Management (REM);
- *Safety Engineering (SE)* with specializations in: Industrial Plant Safety Engineering (IPSE), Marine Environment Safety Engineering (MESE) [1,2].

The Faculty of Marine Electrical Engineering educates students within full-time and part-time studies in two fields as follows:

- Electrical Engineering (EE) with specializations in: Ship Electro-Automation (SEA), Electro-Automation (EA), Computer Control Systems (CCS);
- Electronics and Telecommunication (ET) with specializations in: Marine Electronics (ME), Digital Radio Communication (DRC), Radio Electronics (RE) and Tele-Computer Systems and Networks (TCSN) [3,4].

The Faculty of Entrepreneurship and Commodity Science has both full-time and part-time studies in two fields, specifically:

- *Commodity Science (CS)* with specializations in: Commodity Science and Quality Management (CSQM), Hotel and Tourism Service Management (HTSM), Commerce and Services Product Manager (CSPM), Cosmetic Products Manager (CPM), Nourishment and Dietetic Services (NDS).
- *Management and Marketing (MM)* with specializations in: Enterprise Management (EM), Logistics and Seaborne Trade (LST), Computer Science in Transport and Trade (CSTT), Internet and Multimedia in Management (IMM), Modern Tools of Management (MTM), Accountancy and Finance of Enterprises (AFE), Management Information in Public Administration (MIPA), Management of Human Capital (MHC), Project Management of European Union (PMEU), Management of Shift (MS).

The curricula of all the specializations of studies consist of a subject's timetable with approved credit points in the European Credit Transfer System (ECTS) for the BSc and MSc degrees. One credit equals about 40 hours of student work: 16 teaching hours and the rest is the individual work of the student. One year of studies is equalized to 60 credits [5].

From the academic year 1995/1996, both the Faculty of Marine Engineering and the Faculty of Marine Electrical Engineering provide a specialization in Industrial Plant Engineering (IPE) on the basis of a European Union curricula obtained from Hochschule Bremerhaven, Germany.

The GMU has to its name two training vessels, namely the famous sailing vessel *s/v Dar Młodzieży (Gift of Youth)*, which is used to facilitate sea practice for future marine personnel and the research-training ship *m/s Horyzont II*, which is used for practice in manoeuvring and radar positioning, as well as polar science carried out in cooperation with the Polish Academy of Sciences at Spitsbergen and Antarctica.

## 6.2 Postgraduate Studies

Basically, postgraduate studies are realized by the Faculties in the following fields:

- Ship and industrial of automation systems;
- Programmable controllers PLC and visualization systems;
- Industrial safety systems technologies;
- Electronics elements and power systems;
- Modern antennas and microwave elements;
- Optoelectronics in modern world technique;
- Tourism and hotel management;
- Accountancy;
- Management;
- Nourishment services and dietetics;
- Logistics and international trade.

It should be mentioned that permanent postgraduate maritime training is conducted by the Officer Training Centre Ltd (OTC) in the form of the following courses:

- Courses for certificates of competence for:
  - Operational level (watch keeping officer, watch keeping engineer);
  - Management level (chief officer, master mariner, II engineer, chief engineer).
- Specialist courses for the following certificates:
  - Radar/ARPA operational and management level;
  - Radar simulator;

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- Dynamic positioning operators training - basic, advanced;
- Personal safety and social responsibilities;
- Tanker familiarization training;
- Advanced oil tanker training;
- Advanced liquefied gas tanker training;
- Advanced chemical tanker training;
- Plans for co-operation between passenger ship on fixed routes and search and rescue services;
- Elementary first aid;
- Medical first aid;
- Medical care;
- Basic fire fighting;
- Advanced fire fighting;
- Crowd management, passenger safety and safety training for personnel providing direct services to passengers in passenger spaces on ro-ro and other than ro-ro passenger ships;
- Crisis management and human behaviour, passenger safety, cargo safety and hull integrity on ro-ro and other than ro-ro passenger ship;
- International safety management code;
- Safe handling, stowage and securing of dangerous, hazardous and harmful cargo;
- Bridge team management;
- Electronic navigational charts and ECDIS laboratory;
- ECDIS;
- Practical training in handling of large ships and ships with unusual manoeuvring characteristics;
- Engine room resource management;
- Ship security officer;
- Company security officer;
- Port facility security officer;
- Training in operation and maintenance of main propulsion other than marine diesel engines;
- Training in didactics for instructors;
- VTS training;
- Cargo and ballast hull stability.

### **6.3 Doctoral and Habilitation Studies**

The constant development of teaching staff has been assured by doctoral and habilitation study programs. They are initiated at other educational institutions, but conducted within the scientific laboratories at the GMU.

The studies cover the four fields of scientific research:

- Transport;
- Machine construction and operation;
- Electrotechnics;
- Commodity expertise.



## 7. SCIENTIFIC MARITIME RESEARCH

The University is supported by the Ministry of Science and Higher Education (MSHE) and European Union (EU) research grants in the following forms:

- National research funds: base and statute, allowed according of the scientific and research obtained results in the past years;
- National grants: PhD and DSc, research projects, development projects, allowed by national competition way;
- EU projects;
- International projects.

Each year, the GMU has realized about 20 national and 10 European and international projects. The GMU is now completing certain projects, for example:

- Support system of ship entry to port and mooring as the element of intelligent transport system;
- Quality analysis of electrical energy in shipping electroenergy-systems for the purpose of Chinese Classificatory Companionship regulations modification;
- Real-time detection and presentation of especially large intensity sea traffic areas;
- Analysis and research of the exploitive characteristics active filters to shipping uses;
- Construction of diagnostic and measuring system to research of exploitive features shipping engines and auxiliary devices;
- Construction of specialized project-research system of the latest generation ergo-electronics devices in electro-energy distributional systems;
- Mobile system of command, observations, recognitions and communications;
- Navigational algorithm of determining trajectory parameters in ECDIS electronic map systems;
- Application of asynchronous programmatic agents teams to optimization, simulation and machine-teaching.

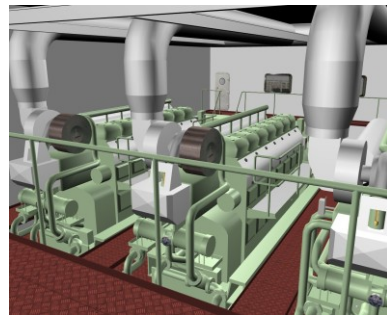
The greatest research-education project referred Namibe Fishery Academy in Angola, included of the technical infrastructure, organization and curricula of maritime specializations on 4 faculties and 21 departments for 2000 students:



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An effect of finished research are practiced devices, for example:

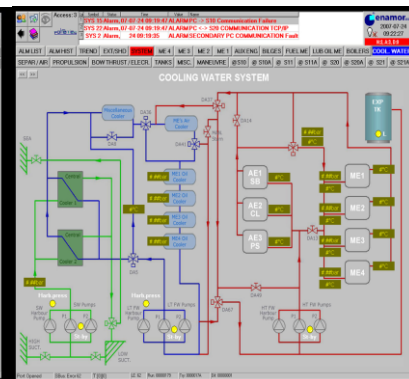
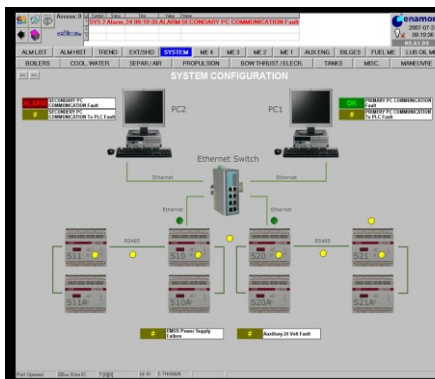
- Engine Room Simulator ERSIM (Department of Marine Propulsion Plants GMU & UNITEST Gdynia):



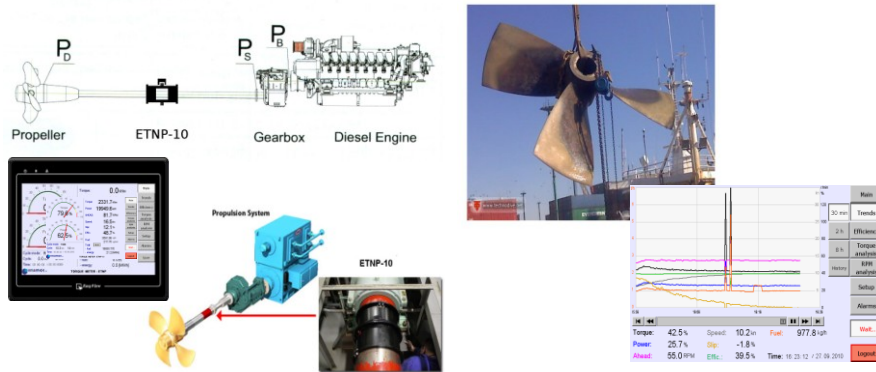
- LPG/LNG Cargo Handling Simulator CHSIM (Department of Marine Propulsion Plants GMU):



- Integrated monitoring and control system EMOS (Department of Ship Automation GMU & PBP ENAMOR Gdynia):



- Control assistance system with torque meter ETNP (Department of Ship Automation GMU & PBP ENAMOR Gdynia):



## 8. JOINT VENTURES

Gdynia Maritime University is engaged in the following joint ventures that support its activities:

- Officer Training Centre Ltd (OTC): postgraduate maritime training;
- Research-Production Enterprise for Maritime Industry Ltd (ENAMOR): projects for shipyards, ship-owners, navy and maritime administration, services in the range of overhauling and repairing ship equipment concerning communication and navigational, marine power plant, electrical and deck gear and cargo handling;
- Foundation for Safety in Navigation and Marine Environment Protection (FSNMEP): ship-handling practical training course for foreign pilots, masters and senior officers, and the use of seven manned models of large ships in scale  $1/16$  and  $1/24$  situated on a lake;
- Academy Maritime Services Ltd (AMS): crewing of Polish officers and ratings for traditional and specialized tonnage and personnel for offshore industry.

## 9. CONCLUSIONS

The current integrated education system, although serving its purpose well, could be further developed through the following means:

- At present working:
  - Curricula harmonization at the secondary level of education;
  - Cooperation between maritime higher education establishments and other industry schools;
  - Wide cooperation of higher education establishments in Poland with foreign institutions.
- Starting up new lines of studies that meet the current needs of the market economy, for example: oil platform operations, mechatronic equipment operations, geographic information systems, commanding large deep sea yachts, etc;

- Starting up new training programs to improve sea safety;
- Introduction of the licensee system to be awarded by the Ministry of Infrastructure for the training centres to improve their quality and to ensure better standards of safety at sea.

## **REFERENCES**

- [1] Cwilewicz R., Tomczak L., "The application of simulation techniques in engineering education", Proc. Conference on Modeling and Simulation, Cairo, (2000), pp 1-12.
- [2] Cwilewicz R., Hajduk T., "Application of a liquefied petroleum gas handling simulator LPG type as a modern didactic tool in marine education engineering", Proc. 5th Baltic Region Seminar on Engineering Education, Gdynia, (2005), pp. 1-8.
- [3] Gierusz W., Lisowski J., "The education of marine engineers in control engineering in accordance with the IMO requirements contained in the STCW'95 Convention", Global Journal of Engineering Education, Vol. 2, No. 2, (1998), pp. 231-238.
- [4] Lisowski J., Wyszowski J., "The new curriculum of education training and certification of marine electrician officers at the Gdynia Maritime Academy", Global Journal of Engineering Education, Vol. 3, No. 3, (1999), pp. 279-285.
- [5] Lisowski J., Śniegocki H., "The Finnish and Polish credit transfer systems for maritime studies" Global Journal of Engineering Education, Vol. 3, No. 3, (1999), 243-248.
- [6] Lisowski J., "Gdynia Maritime University - organization and activity programs in education and research" Proc. 9th Baltic Region Seminar on Engineering Education, Gdynia, (2005), pp.1-6.