Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

West Pomeranian University of Technology, Szczecin

Faculty of Maritime Technology and Transport

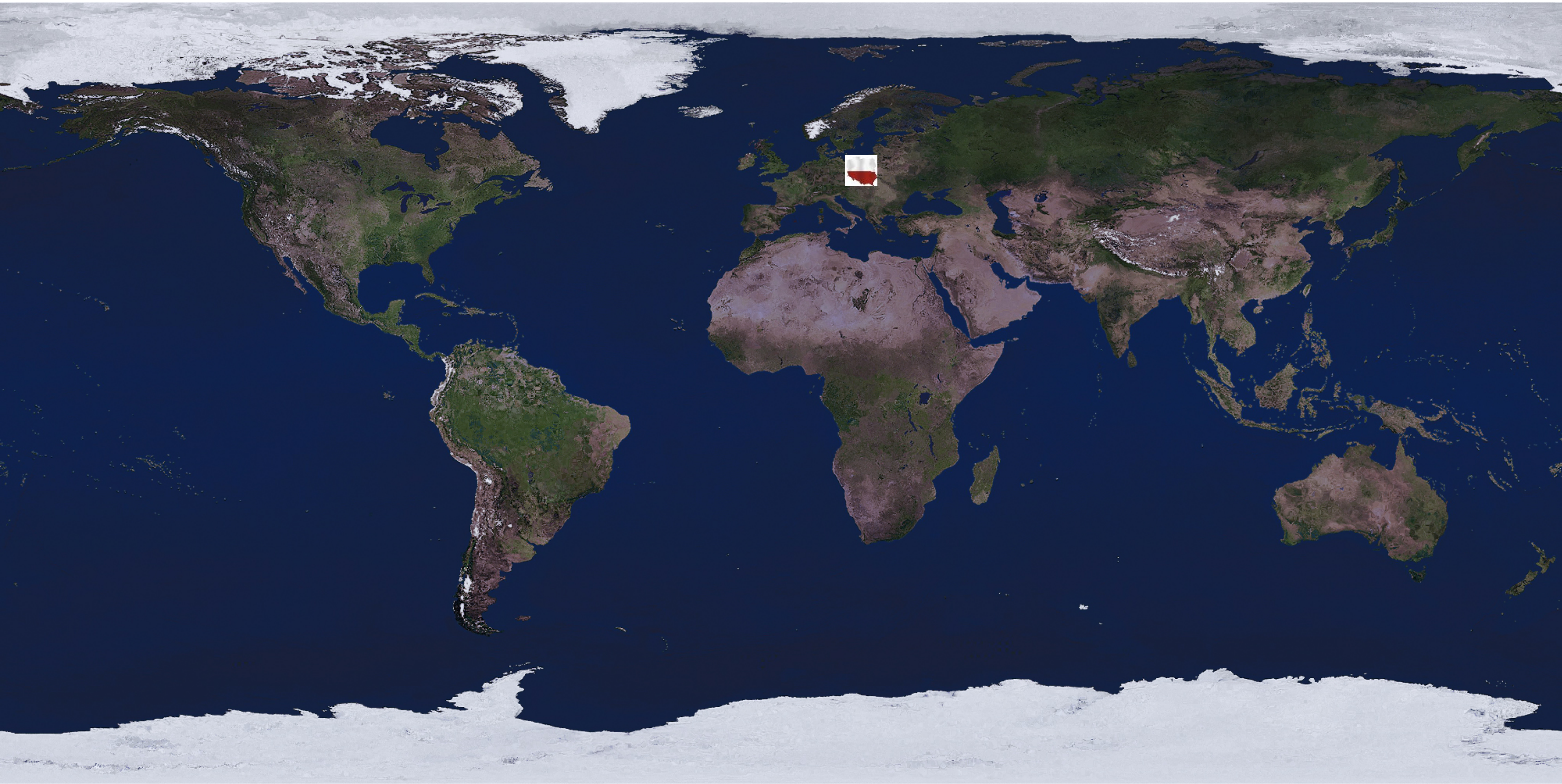
Department of Ship Structure, Mechanics and Fabrication

Presentation of various aspects related to the third semester of EMSHIP at ZUT in Szczecin

Prof. Zbigniew Sekulski

EMSHIP Vice Local Coordinator

Poland

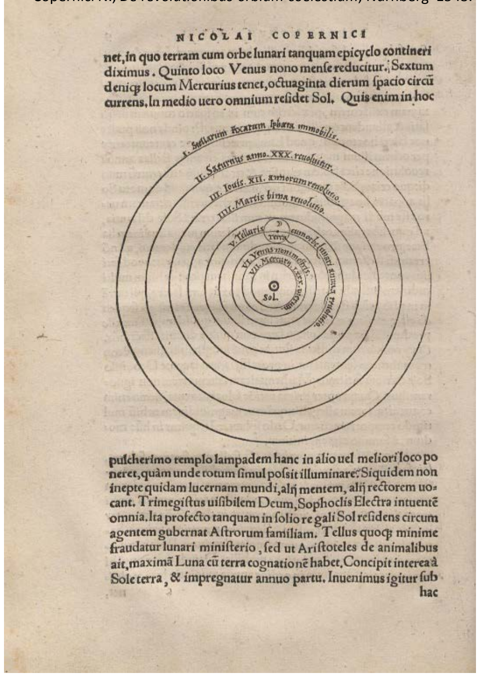


http://nssdc.gsfc.nasa.gov/planetary/image/earth_day.jpg

Nicolaus Copernicus (Polish: **Mikołaj Kopernik**) (born in 19 February 1473, died on 24 May 1543) was a Renaissance mathematician and astronomer who formulated a model of the universe that placed the Sun rather than the Earth at its center.

The publication of this model in his book ***De revolutionibus orbium coelestium*** (*On the Revolutions of the Celestial Spheres*) just before his death in 1543 is considered **a major event in the history of science**, triggering the **Copernican Revolution** and making **an important contribution to the Scientific Revolution**.

Copernici N., *De revolutionibus orbium coelestium*, Nürnberg 1543.



NICOLAI COPERNICI

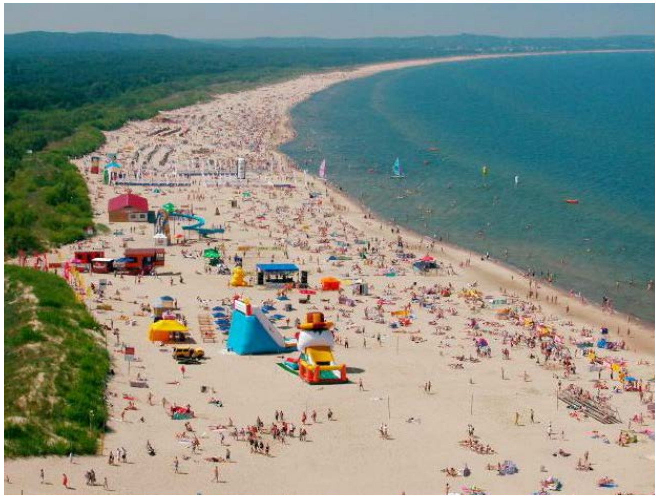
net, in quo terram cum orbe lunari tanquam epicyclo contineri diximus. Quinto loco Venus nono mense reducitur. Sextum denique locum Mercurius tenet, octuaginta dierum spacio circū currens. In medio uero omnium residet Sol. Quis enim in hoc

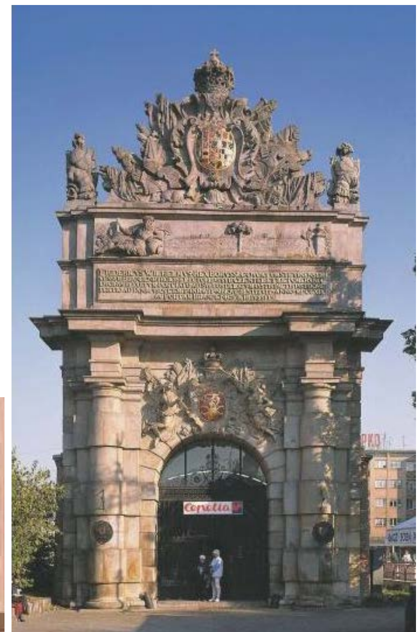
pulcherimo templo lampadem hanc in alio uel meliori loco poneret, quàm unde totum simul possit illuminare? Siquidem non inepte quidam lucernam mundi, alij mentem, alij rectorem uocant. Trimegistus uisibilem Deum, Sophoclis Electra intuentē omnia. Ita profecto tanquam in solio regali Sol residens circum agentem gubernat Astrorum familiam. Tellus quoque minime fraudatur lunari ministerio, sed ut Aristoteles de animalibus ait, maximā Luna cū terra cognationē habet. Concipit interea à Sole terra, & impregnatur annuo partu. Inuenimus igitur sub hac

Szczecin

http://upload.wikimedia.org/wikipedia/commons/0/0e/Europe_countries_map_en_2.png

Szczecin





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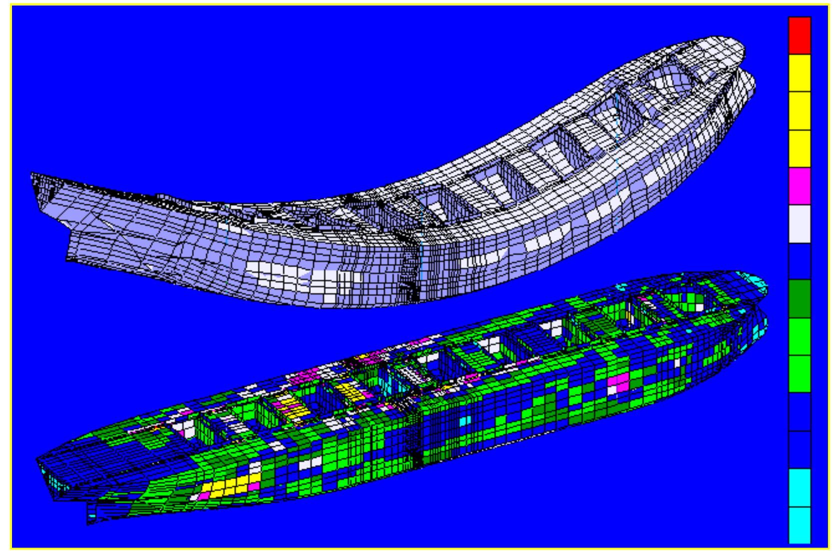
szczecin

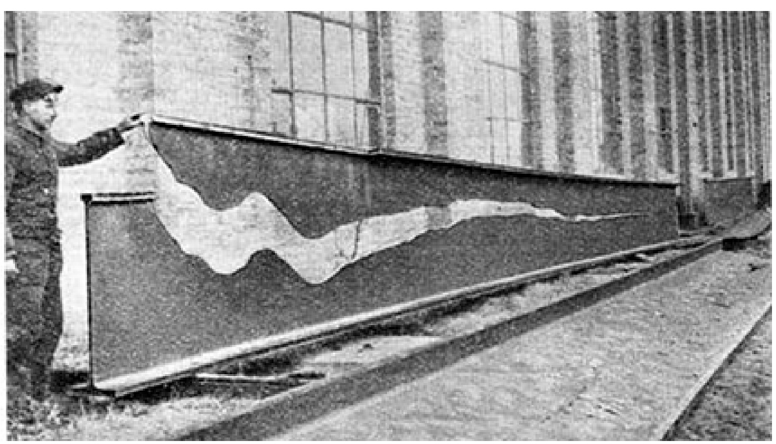
Faculty of Maritime Technology and Transport

Advanced ship and offshore structural mechanics

Ultimate strength: nonlinear finite element analysis: review of theory and applications to ship structures, FEA guidelines for ship modelling, linear and non linear analysis, static and dynamic analysis; strength of ship structures subject to impact loads.



$$\left[\int_V \rho N_{mq} N_{mp} \mathrm{d}V\right]\ddot{d}_q + \left[\int_V D_{kl} B_{lq} B_{kp} \mathrm{d}V\right] d_q = \int_A p_m N_{mp} \mathrm{d}A + \int_V b_m N_{mp} \mathrm{d}V$$



Fatigue and fracture: fundamentals of the fracture mechanics, mechanisms of fatigue failure, methods of fatigue analysis: nominal stress approach, hotspot stress approach, notch stress approach, long-term stress distributions.

$$N\Delta\sigma^m = \frac{1}{C_0\left(\sqrt{\pi}^m\right)} \int_{a_0}^{a_f} \frac{\mathrm{d}a}{\left(Y\sqrt{a}\right)^m}$$

Advanced ship and offshore structural mechanics

Structural reliability and risk assessment:

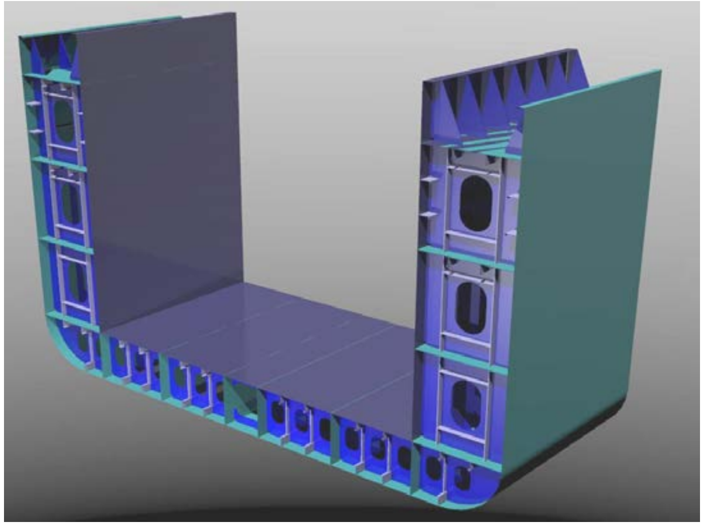
Uncertainties, limit state, failure modes, first and second order reliability methods, safety indices, uncertainties in ship structural design, integration of reliability concepts (loads and strength) in calculation of ship structures (rule based approaches and direct calculations).

$$S_1 = \Phi(-\beta)\prod_{j=1}^{n-1}\left(1-\beta\kappa_j\right)^{-0.5}$$

$$S_2 = \left[\beta\Phi(-\beta)-\varphi(\beta)\right]\left\{\prod_{j=1}^{n-1}\left(1-\beta\kappa_j\right)^{-0.5}-\prod_{j=1}^{n-1}\left[1-(\beta+1)\kappa_j\right]^{-0.5}\right\}$$

$$S_3 = (\beta+1)\left[\beta\Phi(-\beta)-\varphi(\beta)\right]\left\{\prod_{j=1}^{n-1}\left(1-\beta\kappa_j\right)^{-0.5}-\mathrm{Re}\prod_{j=1}^{n-1}\left[1-(\beta+i)\kappa_j\right]^{-0.5}\right\}$$

Advanced ship and offshore structural design

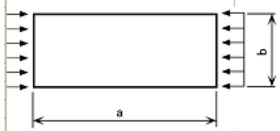


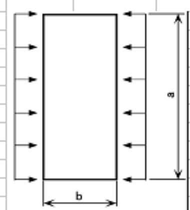
Main characteristics and design objectives of various ship types (passenger ships, bulk-carrier, containership, chemical tanker, liquefied gas tanker, ro-ro, ropax, etc.), use of new materials in the construction of specific ship types (metallic and non-metallic materials, sandwich and core structures), structural arrangement of these specific ship types, loads and strength of these specific ship types, structural details of these specific ship types, IMO conventions and classification societies rules requirements of these specific ship types.

Advanced ship and offshore structural design

Elastic Plate Buckling Under Uni-axial Compression

Longitudinally framed system | **Transversely framed system**



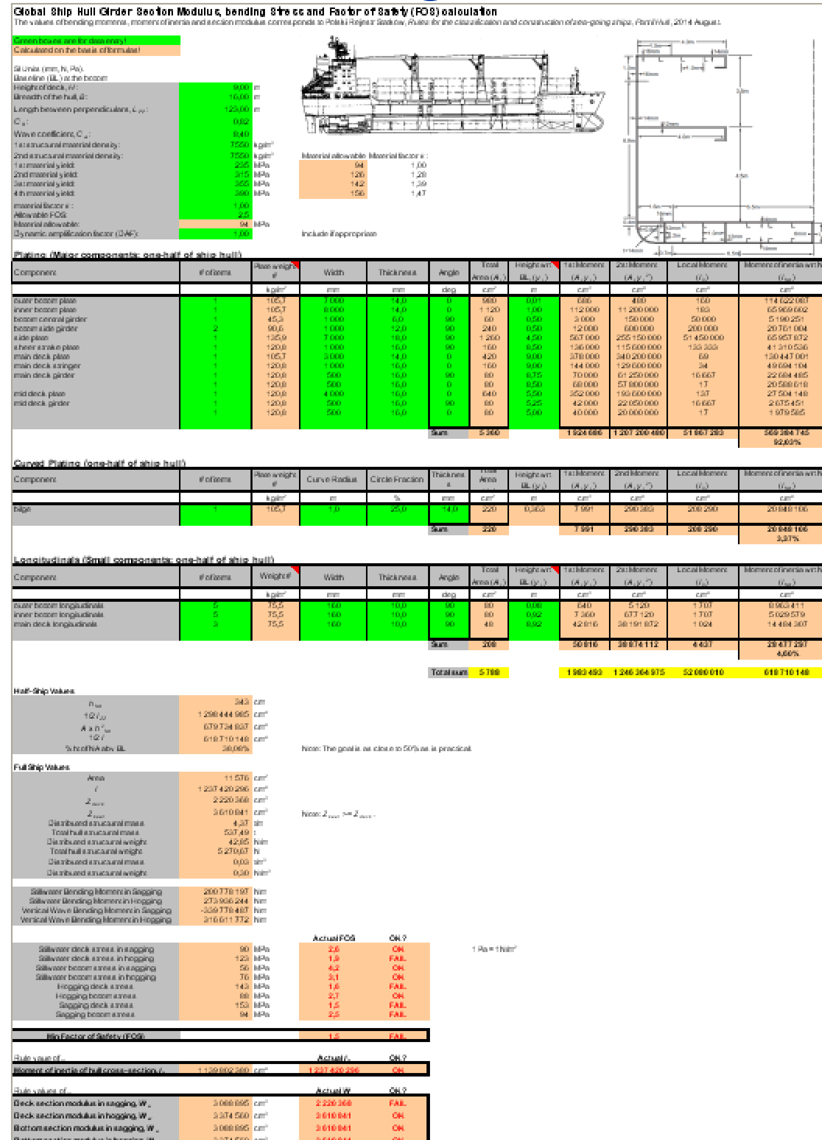


Green boxes are for data entry!
Calculated on the basis of formulas!

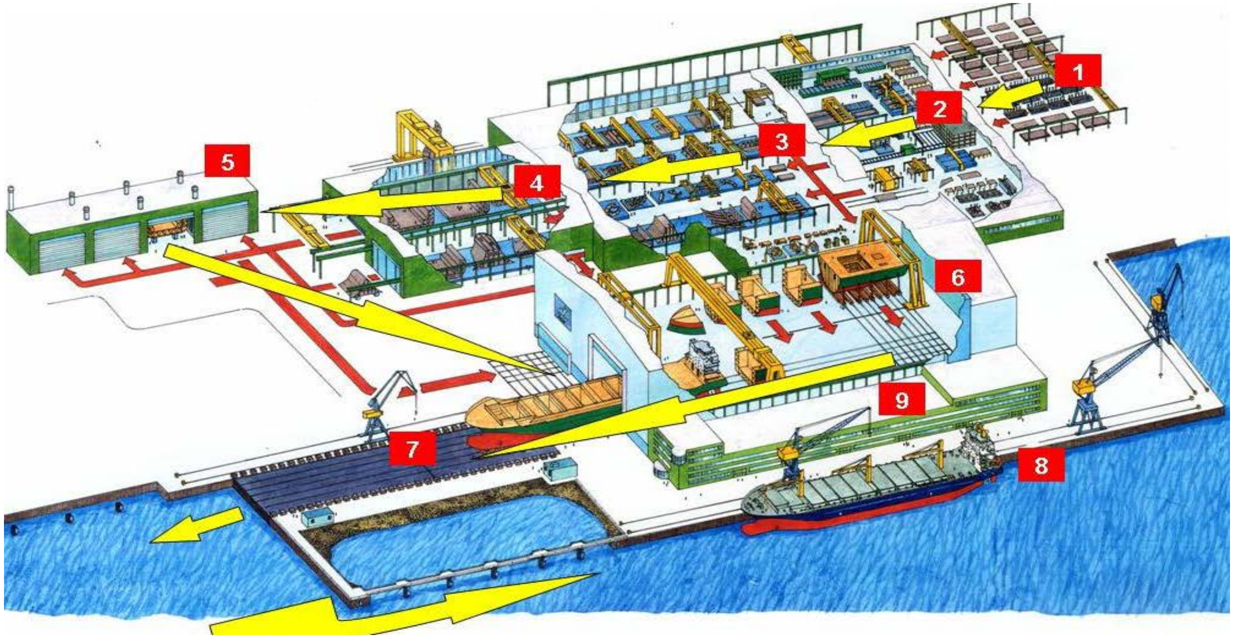
Axial compressive stress σ:	137	MPa	From global hull girder bending
Allowable FOS:	2,5		
Dynamic amplification factor (DAF):	1,00		Include if appropriate

Longitudinally framed				Transversely framed			
plate thickness t =	15,0	mm		t =	15,0	mm	
longer side a =	2 800	mm		a =	2 800	mm	
shorter side b =	700	mm		b =	700	mm	
E =	210 000	MPa	Steel	E =	210 000	MPa	Steel
ν =	0,3		Steel	ν =	0,3		Steel
α =	4			α =	0,25		
k $(m = 1)$ =	18,06			k $(m = 1)$	18,06		
k $(m = 2)$ =	6,25						
k $(m = 3)$ =	4,34						
k $(m = 4)$ =	4,00						
K =	4,00			K =	18,06		
σ_{cr} =	348,26	MPa		σ_{cr} =	98,29	MPa	
	Actual FOS	**OK?**			**Actual FOS**	**OK?**	
	2,5	OK			0,7	FAIL	

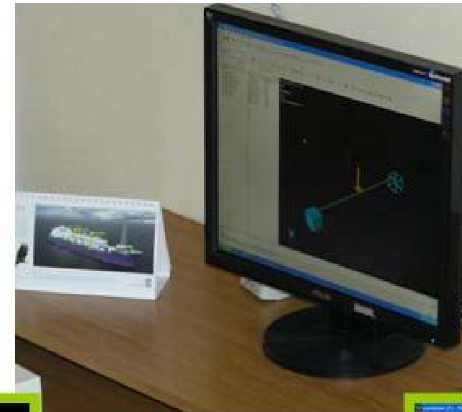
Longitudinally framed				Transversely framed			
plate thickness t =	15,0	mm		t =	15,0	mm	
longer side a =	2 800	mm		a =	2 800	mm	
shorter side b =	700	mm		b =	700	mm	
E =	70 000	MPa	Aluminium alloy	E =	70 000	MPa	Aluminium alloy
ν =	0,33		Aluminium alloy	ν =	0,33		Aluminium alloy
α =	4			α =	0,25		
k $(m = 1)$ =	18,06			k $(m = 1)$	18,06		
k $(m = 2)$ =	6,25						
k $(m = 3)$ =	4,34						
k $(m = 4)$ =	4,00						
K =	4,00			K =	18,06		
σ_{cr} =	118,55	MPa		σ_{cr} =	33,46	MPa	
	Actual FOS	**OK?**			**Actual FOS**	**OK?**	
	0,9	FAIL			0,2	FAIL	


Global Ship Hull Girder Section Modulus, bending Stress and Factor of Safety (FOS) calculation

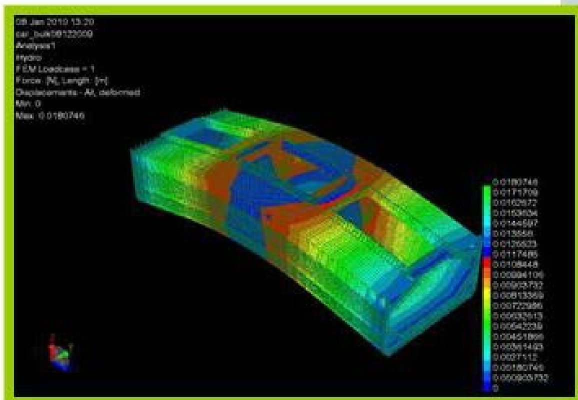
Advanced ship and offshore production technology

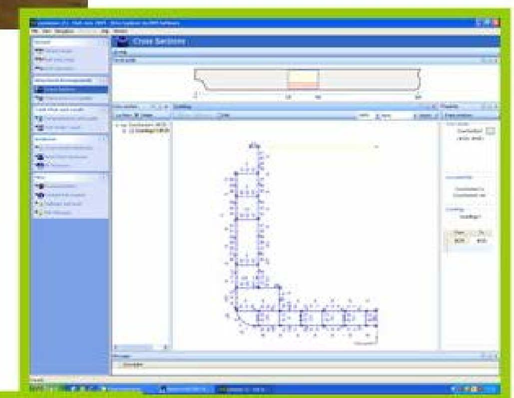


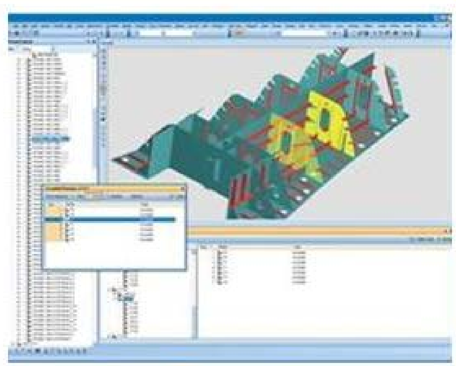
Technology of building of specific ship types, technology of building ships supporting offshore industry, technology of building offshore floating steel and concrete structures, application and manufacturing technology using innovative sandwich structures to ship hull, non-conventional methods of ship launching, underwater technology – fabrication and application of manned and unmanned vehicles.

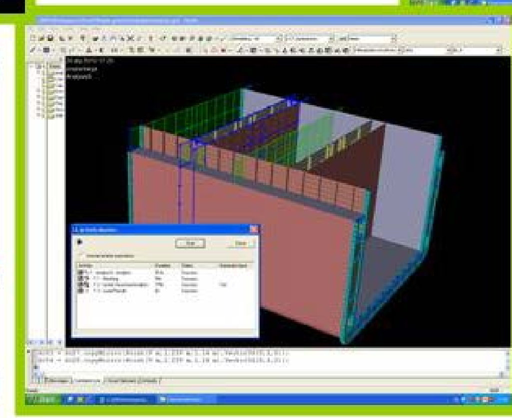


- ANSYS
- DNV Software:
  - GeniE
  - PreFEM
  - Sesam
  - Sestra
  - WaveShip
  - Nauticus Hull
- Poseidon
- Aveva (Tribon)



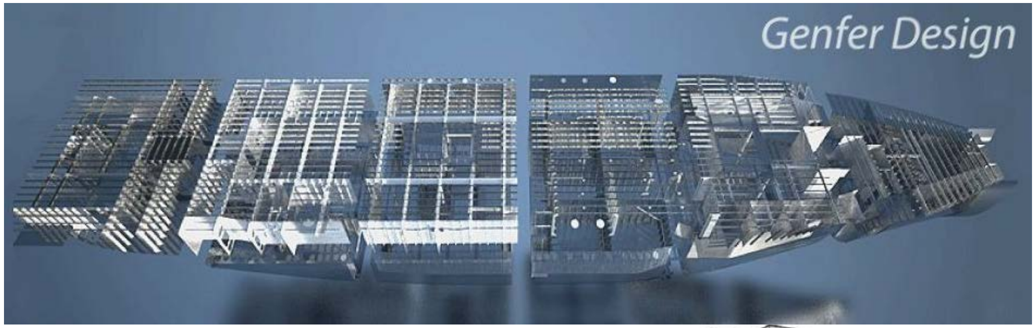


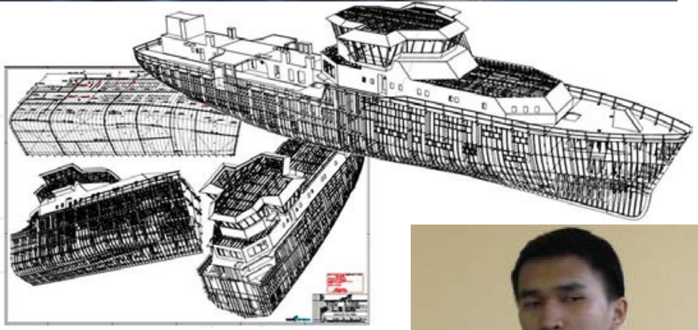




Andrey Smolko

Structural response of the ship hull elements subject to excitation generated by the main engine





Structural Design of Helicopter Landing Platform on Offshore Ship

MARIN TEKNIKK

Wai Lin Tun

Calculation of Fuel Consumption and Exhaust Emissions from Ship in Ice Conditions

Duong Quang Tan

Jiawei Zou

Investigation of the hull-superstructure interaction in order to predict the contribution of superstructures to hull girder strength

BUREAU VERITAS 1828

Gdańsk Shipyard

Structural design of Platform Supply Vessel less than 90m

Hailemariam Desalegn Eltiro

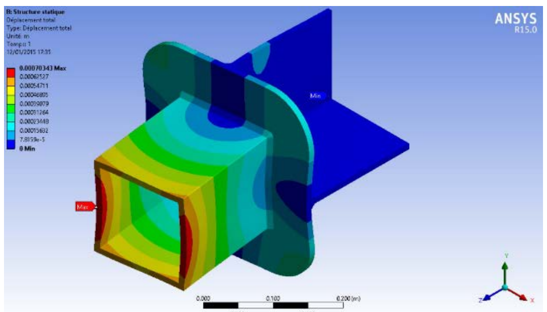
Analysis and prediction of welding deformations of ship panels in prefabrication process

Huggo S. Batista

stx France

Arnaud Le Pivain

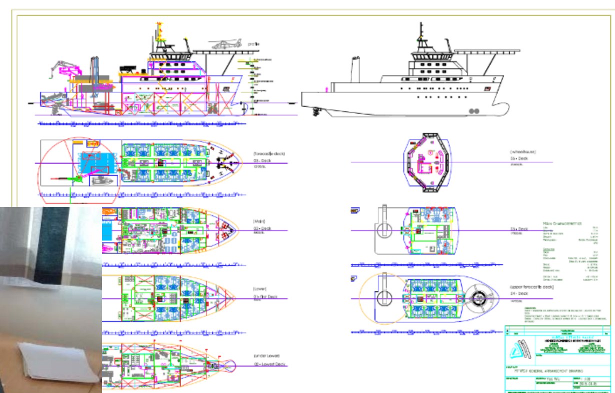
Pillars definition and dimensionning, Verification and Validation of FEM parametric model



BUREAU MAURIC
Naval Architecture & Marine Engineering

Yue Wu

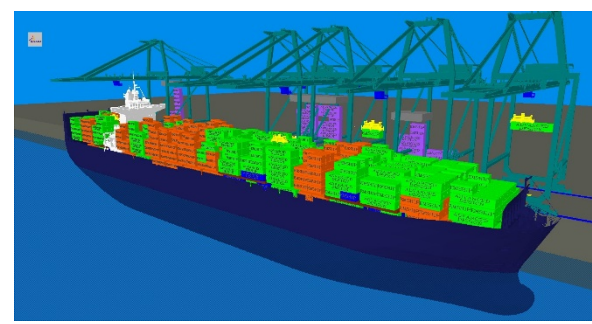
Concept Design of a Station Keeping Vessel Dedicated to Maintenance of the Far Shore Wind Farm



Universidade Federal do Rio de Janeiro

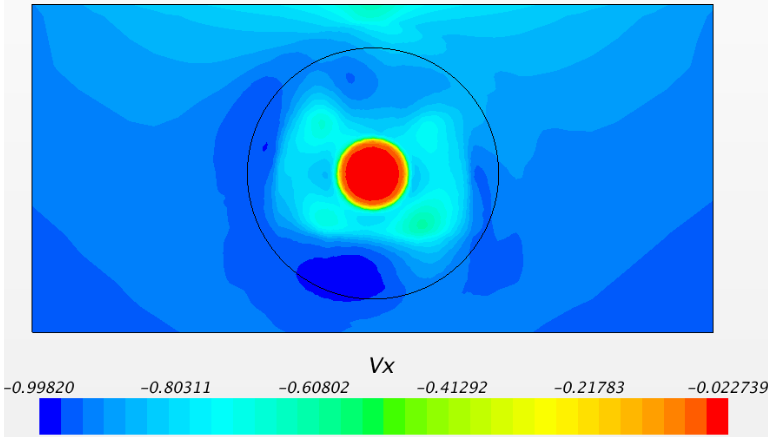
Rasih Onur Suzen

Discrete Event Simulation Helps to Improve Terminal Productivity for New Design Container Ships



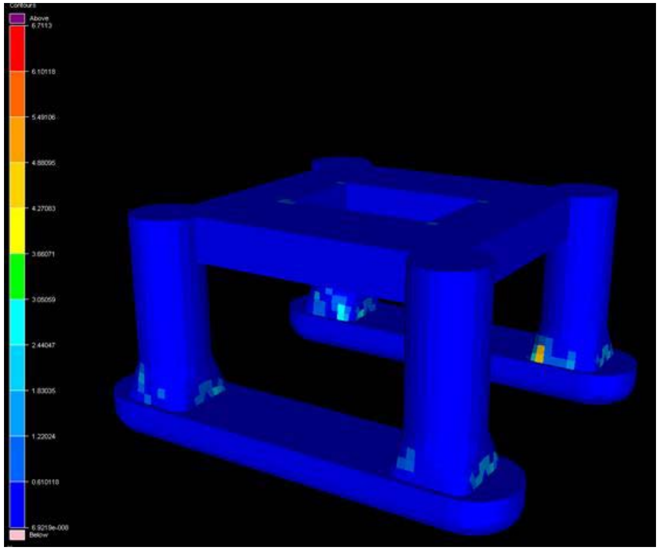
Prabu Duplex

Novel application of large area propeller to optimize Energy Efficiency Design Index (EEDI) of ships



Md Rezaul Karim

Fatigue Analysis of Offshore Drilling Unit



DNV-GL Group, Gdynia:
- Fatigue calculations analysis of floating drilling platform.

Crist Shipyard, Gdynia:
- Analysis of manufacturing process with respect to automation and mechanization of welding of ship structures.

Finomar Shipyard, Szczecin:
- Technology of ship hull building.

Marine Repair Yard GRYFIA:
- Analysis of structural strength of floating dock,
- Structural design of icebreakers – modifications.

Ship Research Centre, Gdańsk:
- Thermal/fatigue finite element analysis of structural strength of ship hull elements,
- Experimental investigation of hydrodynamic properties of ships.

Groot Ship Design Poland, Szczecin:
- An investigation into damaged ship stability.

Westcon Design Poland, Szczecin:
- Structural design of a PSV.

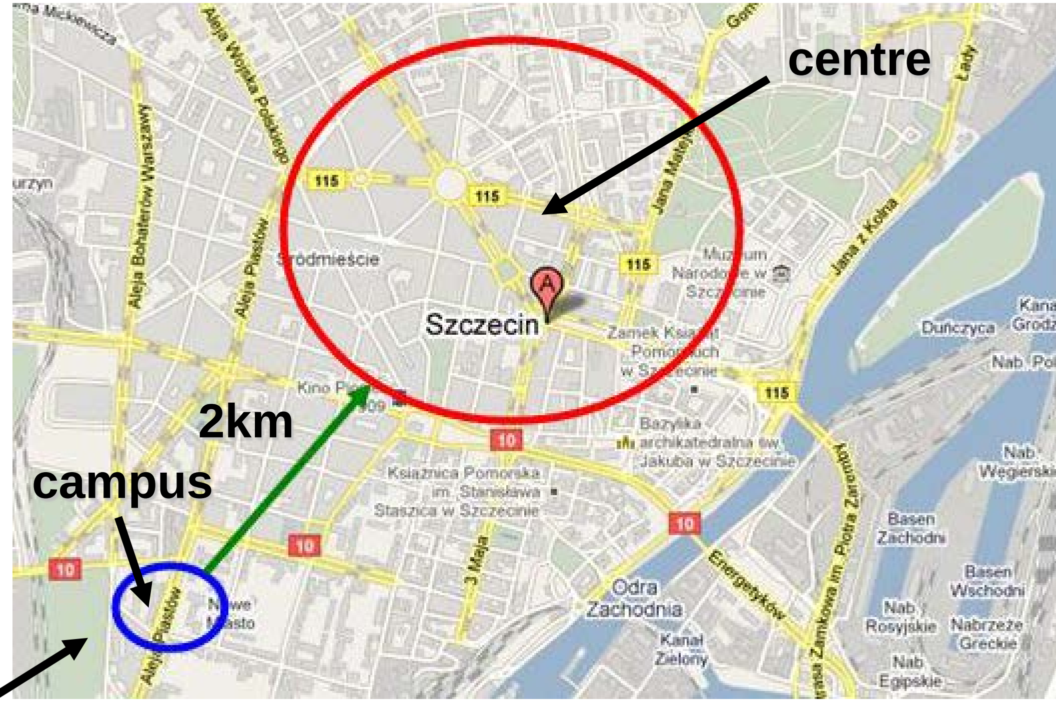
Marine Teknikk, Szczecin:
- Structural safety analysis of tankers/containers/bulk carriers/offshore oil rigs in a view of accidents.

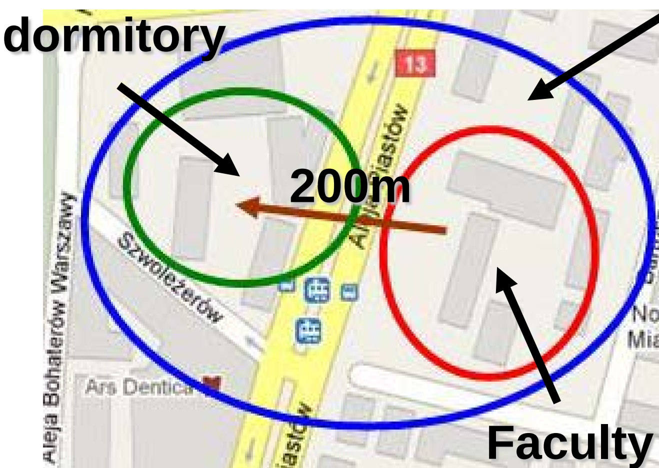
Interocean-metal Joint Organization, Szczecin:
- Preliminary and structural design of a mining ship.

Internships abroad are possible!

http://nssdc.gsfc.nasa.gov/planetary/image/earth_day.jpg

Practical aspects - orientation





Practical aspects - dormitory

Single room – 490 PLN (120 €) / month

Practical aspects - prices

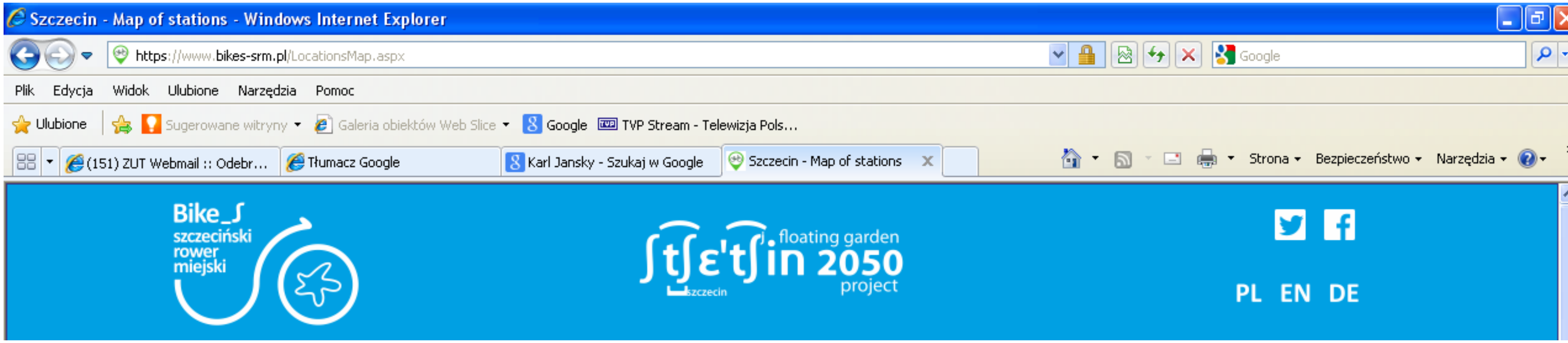
Lunch : 10 – 20 PLN (2.5 – 5 €)

Entrance ticket: 10 – 50 PLN (2.5 – 12 €)

1 € ≈ 4,20 PLN

A beer: 3 – 6 PLN (0.75 – 1.5 €)

Practical aspects – Bike-S



Initial fee: 20 zł
Minimal fee: 10 zł

From 0 to the 20th minute: 0 zł
From the 21th to the 60th minute: 1 zł
From the 61th to 120th minute: 3 zł
From the 121th to the 180th minute: 5 zł
Each subsequent hour: 7 zł

https://www.bikes-srm.pl

Practical aspects - formalities

International office in ZUT
(paper-copy
and electronic versions in PDF format)

Inputs:

- EMSHIP application form
- 3 photos, size 35x45 mm
- A copy of passport or ID
- A copy of student ID
- Accommodation form, if applicable

Outputs:

- Acceptance letter
- Room reservation in dormitory

Dean's office in Faculty
(personally during registration)

Inputs:

- 3 photos (if have been not send earlier)
- Passport or ID card (for EU citizens)
- Student's cards (ULG and ECN)
- Scholarship certificate
- Insurance policy
- 17.00 PLN for student ID

Outputs:

- Student's ID card (ZUT)
- Access to computer system / wi-fi network (login, password)

Why not coming to Szczecin ???

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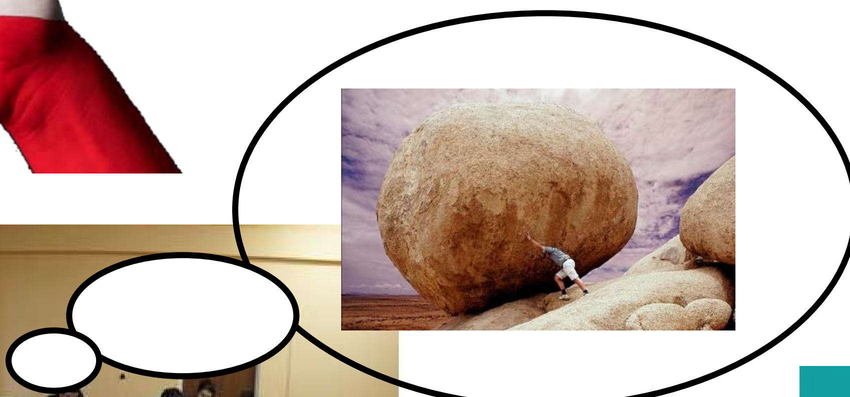

EMship Advanced Design