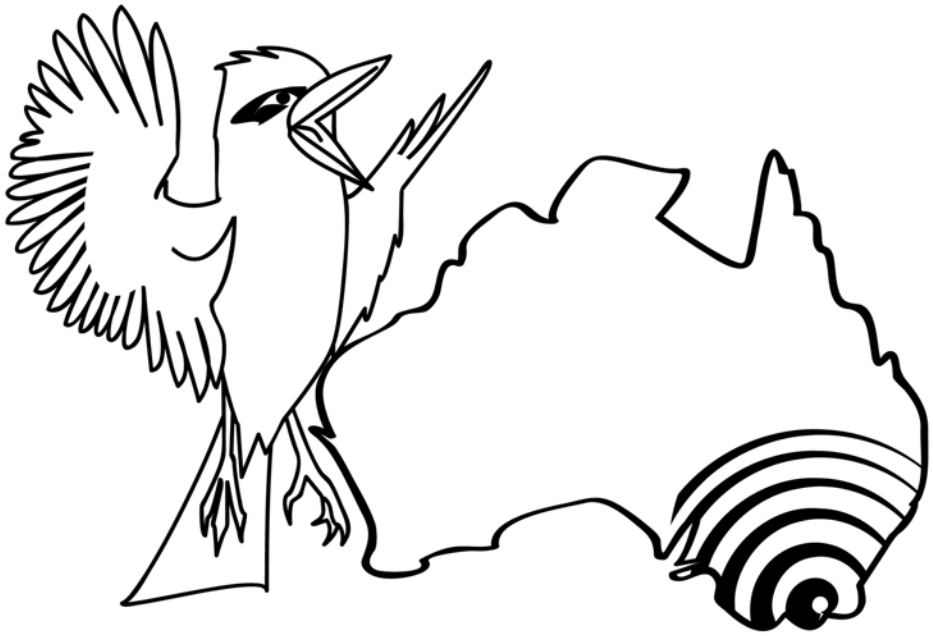
Informatiefolder Casestudies

Cookaburra ‘11



Cookaburra ‘11

Inleiding

U leest in de *Informatiefolder Casestudies* van Cookaβurra ’11, de studiereis naar Australië die in april 2011 zal plaatsvinden. Deze studiereis is bedoeld voor studenten (Technische) Wiskunde, Informatica, (Technische) Natuurkunde, Sterrenkunde en Biomedische Technologie aan de Rijksuniversiteit Groningen. Ze wordt georganiseerd door een commissie vanuit de stichting GBE-FMF.

In deze folder vindt u informatie over de casestudies die wij aanbieden: een omschrijving en een aantal verslagen van in het verleden uitgevoerde casestudies. Wilt u meer verslagen bekijken, dan kunt u terecht op websites van voorgaande reizen:

iguazu.fmf.nl (2009)
tigers.fmf.nl (2007)
www.fmf.nl/stars (2005)

Bent u geïnteresseerd in een casestudy en heeft u vragen of suggesties, dan vindt u achter in de folder onze contactinformatie.

Casestudy

Bij een casestudy werken twee studenten fulltime drie weken aan een project in opdracht van een bedrijf of instantie. Het kan hierbij gaan om een onderzoek- of stageopdracht in de bovengenoemde vakgebieden. Dit is bijvoorbeeld een statistische analyse, een literatuurstudie, ontwerpen van een database of metingen uitvoeren. Op de universiteit aanwezige expertise en apparatuur spelen hierbij vaak een sleutelrol.

Studenten

De commissie selecteert ouderejaars studenten die affiniteit hebben met het project en gekwalificeerd zijn om het project tot een uitstekend resultaat te brengen. De studenten worden door een hoogleraar begeleid. Deze houdt toezicht en geeft eventueel advies.

Uw Bedrijf

Dit is de uitgelezen kans voor bedrijven om projecten, die anders blijven liggen of uitbesteed worden, tegen een relatief lage prijs uit te laten voeren. Om bij ons een casestudy uit te laten voeren betaalt u namelijk €3600,-

Verder is het een goede gelegenheid om ouderejaars studenten intensief in contact te laten komen met uw bedrijf. Met een verslag van de casestudy (op de website en in het eindverslag) zullen ook andere studenten kennis nemen van de activiteiten in uw bedrijf.

Tevens bieden wij u kosteloos een advertentie in het eindverslag en een logo op de website aan.

Verslagen Casestudies

Vanaf de volgende pagina vindt u de Engelstalige beschrijvingen van een vijftal casestudies, die in het (recente) verleden zijn uitgevoerd. Hieronder staan daarvan korte samenvattingen.

RSP Technology – uit 2007

Deze case werd uitgevoerd in opdracht van RSP Technology. Dit is een Nederlands bedrijf dat aluminium legeringen maakt voor de auto-, en recentelijk ook, de optische industrie. Het doel van de case was om de microstructuur van een dergelijke legering te bestuderen. Tijdens het onderzoek is er optimaal gebruik gemaakt van de faciliteiten van het Zernike Institute for Material Science om RSP Technology meer inzicht in hun product te geven.

Pagina 4

Deloitte – uit 2007

Het doel van de casestudy van Deloitte, werkzaam in accountancy, consultancy, belasting en financieel advies en met een afdeling voor de ontwikkeling van financiële modellen, was het implementeren van een Heston volatiliteitmodel in C+ om zo een prijs van een optie te bepalen. Hierbij werd voortgebouwd op programmatuur die al door Deloitte ontwikkeld was.

Pagina 5

Deltares – uit 2009

Deze case werd uitgevoerd in opdracht van Deltares, een instituut gespecialiseerd in waterbeheer. Het doel van de case was om onderzoek te doen naar de manier waarop gasbellen getransporteerd worden in water. Dit werd gedaan door de weerstandscoëfficiënt van de bubbels te bepalen. Ook werd de relatie tussen de verschillende eigenschappen van de bellen en deze weerstandscoëfficiënt bepaalt.

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Noordhoff info. – uit 2009

In opdracht van Noordhoff uitgevers, de uitgever van "Moderne Wiskunde", werd een spel ontwikkeld voor op de website. Het spel heeft als doel om rekenvaardigheden te testen. Het bestaat uit verschillende ballen met antwoord en vraag die in de juiste manier gecombineerd moeten worden. Een versie van dit spel zal op de website geplaatst worden.

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SRON – uit 2009

De case van SRON, het Nederlandse instituut voor ruimte onderzoek, bestond uit het verbeteren van de internetsite over de HIFI. De HIFI is een nieuw instrument, waarvan SRON de hoofdonderzoeker is. Het was daarom belangrijk dat de informatie hierover duidelijk is en gestructureerd te vinden is. Om de website vorm te geven is met verschillende wetenschappers gesproken. Uiteindelijk is er een overzichtelijke site afgeleverd.

Pagina 10

Case - RSP Technology

RSP Technology is a Dutch company that produces aluminum alloys for the automotive-, and recently also optical industry. RSP produces the alloys through the Rapid Solidification Proces, hence the name RSP. In this process, also called meltspinning, aluminum and additional alloying elements are molten at a temperature of about 850 degrees Celsius. In this liquid phase the mixture hits a fast rotating copper wheel, which almost instantaneously releases a continuous metal ribbon at room temperature that will be chopped into flakes. After a couple more production steps (like compacting of the flakes and pressing to produce a billet), the billet is extruded into a profile. For the production of the RSA-6061 T6 alloy, the profile will undergo a T6 heat treatment. This alloy can be made into high quality mirror surfaces with very low roughness of 1-5 nm (conventional AA6061 has a roughness Ra of 5-10 nm). For optical applications like mirrors, a fine microstructure of the rapid solidified alloy is of great importance.

Case

However, since this alloy is produced only by RSP Technology, not much is known of its microstructure. Specific details of the microstructure, found with LM investigation might influence optical characteristics. The composition and shape of typical features had to be determined.

Implementation

Having this information might bring forward a solution to improve the alloy. For this research, RSP has requested if a student could investigate the microstructure
of this alloy. Therefore, analysis was performed using the light microscope (LM) and the scanning electron microscope (SEM). The latter gave us the opportunity to apply EDX (Energy Dispersive X-Ray) and OIM (Orientation Imaging Microscopy), two techniques that give information about the elements in a qualitative and quantitative way and about grain size and the distribution of existing phases. In EDX analysis an electron beam strikes the surface of a conducting sample. This causes X-rays to be emitted from the material. The energy of the X-rays emitted depend on the material under examination, so a spectrum of the elements present can be created. Also, a topographical image of the distribution of the elements is made. The other technique, OIM (Orientation Imaging Microscopy) is based on automatic indexing of electron backscatter diffraction patterns (EBSP). OIM provides a complete description of the crystallographic orientations in polycrystalline materials. For good OIM patterns, we needed to try different methods of polishing the material. The best method turned out to be precision ion polishing (PIP).

Conclusion

Unfortunately this was a time-consuming method. The analysis was quite a bit of work, since I had no preliminairy knowledge of the microscopes. Despite this I became well well aquinted with the material quickly and had to gained a right right amount of responsibility. With the case it is hoped that RSP Technology has gained more insight in and to optimize their product. Thanks should go to Gert ten Brink and prof. dr. De Hosson of the Material Science department for taking the time to teach me how to use the equipment and for their help me throughout the project.

Case - Deloitte

Deloitte is an independent 'member firm' of the international Deloitte Touche Tohmatsu Verein. With approximately 6,000 employees and holdings spread across the Netherlands, Deloitte is the largest organization in The Netherlands in the field of accountancy, tax advisement, consultancy and financial advisement. Deloitte also has a department responsible for the development of financial models. Our casestudy originates from this more math oriented department.

Case

The purpose of the case was to program a Heston model in C#, to determine the price of an option. An option is the right to buy or sell a certain good against a pre-determined price, within a prior agreed period. In the case these goods were shares. To obtain the right to sell or buy a share for a certain price, the buyer pays a certain amount of money. The price of an option is a compensation for the financial risk the seller is subjected to, but on the other hand it has to be sufficiently low to interest buyers. A fair price is thus a balanced one, depending on the price the underlying share could adopt.

Implementation

The already existing framework of the assignment at Deloitte, was a Black-Scholes Monte Carlo model. This model is based on the Black and Scholes option valuation formula, which gives an analytical approach of the option price. Using the Monte Carlo simulation, a large number of different paths are simulated for the different prices of the underlying share. Eventually the mean of these paths is used. In the Black-Scholes approach the standard deviation in the price change of the share, the volatility, is considered constant. However, from the share market it can be seen that this assumption proves to be incorrect.
The assignment was therefore to extend the existing model to a model in which the volatility of the share is also stochastically modeled, in other words to create a "Heston model".
For the implementation of the case, we had to learn a lot about the financial world and its underlying math. This was accompanied by a great share of programming. One enjoyable aspect of the case was the fact that the students had a clearly bounded assignment. However, during this assignment the students encountered some technical and non-technical obstacles. This varied from correctly reading in input values, to deciding upon the right formulas for the calibration of the model.

Conclusion

All this made the case a challenging one, from which the students learned a lot. In combination with pleasurable supervision from Deloitte, it all eventually led to a, for Deloitte, usable final product.

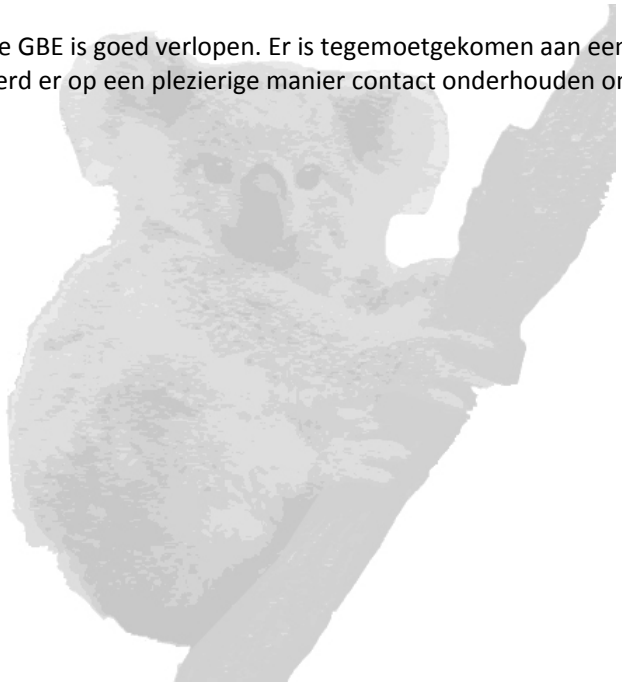
Evaluation

See for the Dutch evaluation below.

In oktober 2006 nam de FMF contact op met Deloitte via een oud FMF’er binnen Deloitte. Omdat dit een goede manier leek om extra werk gedaan te krijgen en daarnaast goede promotiemogelijkheden opleverde hebben we besloten twee teams van twee studenten aan een case te laten werken.

Een van de cases werd uitgevoerd door een studente Sterrenkunde en een studente Informatica. Het doel van de case was het implementeren van een Heston volatiliteitsmodel in C+. De studentes hebben voortgebouwd op de programmatuur die al door Deloitte ontwikkeld was.
De case is goed verlopen. De studentes maakten zich de ingewikkelde onderliggende theorie snel eigen en stelden veel vragen voor verdere verduidelijking. De case bleek wel ingewikkelder dan vooraf verwacht waardoor uiteindelijke simulatiestudies niet zo uitgebreid zijn gebeurd als vooraf gepland was. De studentes hebben zich echter zeer goed ingezet om toch zo veel mogelijk gedaan te krijgen. Het uiteindelijke resultaat is een werkend model dat wij kunnen gaan gebruiken. We zijn dan ook zeer tevreden met de case.
De studentes hebben aangegeven met plezier aan de case gewerkt te hebben en ook iets opgestoken te hebben van een vakgebied dat niet direct aan hun studie gerelateerd is.

Het contact met de commissie GBE is goed verlopen. Er is tegemoetgekomen aan een aantal wensen van Deloitte en regelmatig werd er op een plezierige manier contact onderhouden om alles in goede banen te leiden.



Case-Deltares

From January 1st 2008, the Netherlands benefits from a new and independent institute for applied research and specialist advice. Together with Rijkswaterstaat/DWW, RIKZ and RIZA, WL | Delft Hydraulics, GeoDelft, and a part of TNO Built Environment and Geosciences form the Deltares Institute. The institute employs more than 800 people. Deltares has a unique combination of knowledge and experience in the field of water, soil and the subsurface. It is frontrunner in the development, distribution and application of knowledge for meeting the challenges in the physical planning, design and management of vulnerable deltas, coastal areas and river basins. Deltares works for and cooperates with the Dutch government, provinces and water boards, international governments, knowledge institutes and market parties. The institute is located in two cities: Delft and Utrecht.

Background of the case-study

Gas pockets in pressurised waste water mains cause significant capacity reductions, resulting in unnecessary CSOs (Combined Sewer Overflows) and excessive power input. The current state of knowledge on the rate at which a gas pocket is transported through a downward slope, is limited. The CAPWAT joint industry project (Capacity reduction in wastewater pressure mains) is co-funded by most Dutch water boards, several consultants and research foundations. The objectives of the CAPWAT project include:

- Development of a detection method for gas pockets
- Development of measures to minimise air inflow
- Determination of the required velocity to remove capacity reducing gas pockets
- Rate of gas pocket breakdown and transport
- Guidelines for design, operation and maintenance of wastewater mains

High speed camera observations have been made in order to get information about behaviour of gas pockets in pressurised water.

Case

A certain amount of gas and a certain amount of water are flown through a declining pipe. Thirteen series of pictures, each series with other flow rates, are taken from above. Each series contains 100 pictures. The pictures show a pattern of bubbles. From this pattern the drag coëfficient has to be estimated.

Method

A formula for the drag coefficient is derived by using Archimedes law and the formula for the drag force

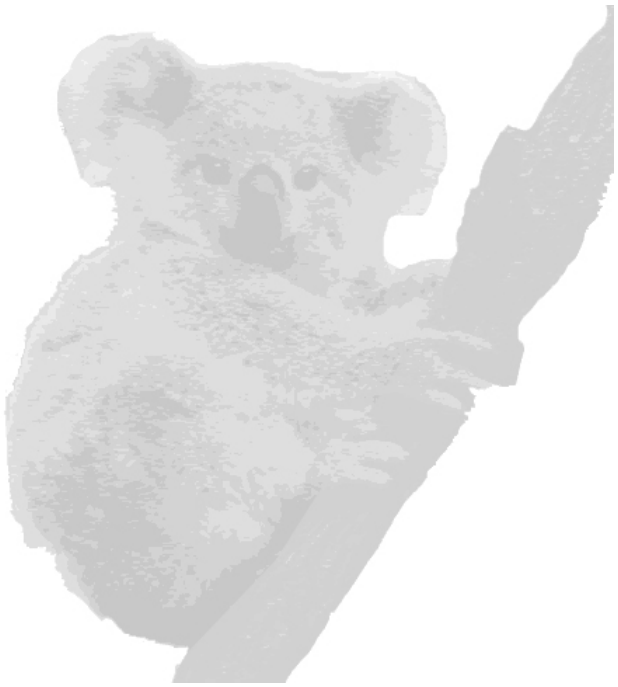
$$C_d = \frac{2A_i\bar{h}g}{v^2 A_b}\left[sin(\alpha) - \frac{dH}{ds}\right]$$

- Ai the interface area of the bubble; this quantity is determined directly from the TIFFs;
- α the angle of the pipe;
- ρ the mass density of the fluid; In this case 1000 g/l;
- v the speed of the bubble relative to the fluid; The speed of the bubble can be determined directly from the TIFFs, the speed of the fluid can be calculated if the outflow and the cross-section of the pipe are known;
- Cd the drag coefficient of the bubble;

• Ab the frontal (or bubble) area of the bubble; This quantity is obtained by measuring the maximal width of the bubble, multiplied by a constant h;
• *h* is the average height of the bubbles, which can be calculated if the total outflow of air and the number of bubbles per second is known. We assume here that the difference in bubble heights is negligibly small.
• $\frac{dH}{ds}$ is the pressure gradient of the liquid in the declining pipe. The pressure gradient is determined by using the Colebrook-White equation and the Swamee-Jain equation.
A picture viewer and a picture manipulation program are used to determine bubble velocity, interfacial area of each bubble and the maximum width of each bubble.

Conclusion

The relations between drag coefficient and bubble volume, between drag coefficient and fluid velocity, between drag coefficient and distance between bubbles and between drag coefficient and relative velocity are obtained. The relation between drag coefficient and bubble volume strongly depends on the ratio between gas flow rate and liquid flow rate. The drag coefficient seems to be constant for different fluid velocities in the range of 100 – 150 cm/s. Also the distance between the bubbles does not influence the drag coefficient.



Case-Noordhoff Uitgevers

Noordhoff Uitgevers (Noordhoff Publishers) has its roots in Groningen. In 1836, Jan Berends Wolters started a book- and papershop at the Guldenstraat. This shop expanded to become a renowned publisher of books like the Bos' schoolatlas (from 1877), the novels about Ot and Sien (1902) and the famous Aap-Noot-Mies (about 1910). In 1858 Popko Noordhoff started a publishing office at the Herestraat. He specialised in scientific and school books. In 1968 Wolters and Noordhoff merged. Until 2007 Wolters-Noordhoff was part of the division of Education at Wolters Kluwer, then they were sold to Bridgepoint Capital. This caused the change of name from "Wolters Noordhoff" to "Noordhoff Uitgevers". Since its beginning as Wolters in the Guldenstraat, Noordhoff Uitgevers has developed to become the largest educative publisher of the Netherlands, with over 400 employees today, established in Groningen and Houten.

Case

During math classes in high school, a much-used method is the book "Moderne Wiskunde" ("Modern Mathematics"). This book is accompanied by an electronic study environment on the website of Noordhoff. This site contains a number of i-clips where theory is explained and exercises can be made. For this casestudy, Noordhoff had the request to create a new i-clip, meant to practice calculation skills. The concept was to practice mental calculation with the operations like add, subtract, multiply, divide, take the root and raise to some power. We made a game concept in which the problems and answers exist as balls that roll over the game field and need to be combined with each other in the right way.

Figure: the game

The making of the game

The game (see figure) was made with Adobe Flash CS4, with the code written in ActionScript 3.0. First, we made a sum generator that creates an arbitrary problem with some operation and criteria concerning the numbers. For example, with multiplication the first number contains at most two digits
and the second number at most one. A game field with sumballs (balls with problems) was made, and at fixed moments new sumballs are generated at the top left corner of the screen. When an answer is typed and the enter button is pressed, the answerball appears with the – hopefully correct – answer. The sum- and answerballs can be dragged by mouse, so that they can be combined.
And when they get impulse by using the mouse they will keep rolling until they hit each other. When the answer is correct the player is rewarded points and otherwise he or she gets a penalty.
A collision algorithm was programmed that enables the balls to collide realistically. Also, a saw was added that can remove answerballs, and the sumballs explode after some time creating a shockwave.
A scoreboard and a level setup with five levels and three difficulty levels was made.
The game has been sent to the authors of the Moderne Wiskunde manual and it was received well. There were some ideas for further improvement and for features that could be added. The current version will be put on the website of Noordhoff, and maybe a new version will be made in the future.

Case-SRON

SRON, Dutch Institute for Space Research, is a Dutch agency that was founded in 1983. The institute has two facilities, one is located in Utrecht and the other one in Groningen. SRON focuses her attention on the development of satellite instruments. The institute develops and uses innovative technology for groundbreaking research in space focusing on astrophysical research, earth sciences and planetary research. In addition to this, SRON has a line of research into new and more sensitive sensors for X-rays and infrared radiation. The selection of these research disciplines is based on choices made on the basis of instrumental expertise and on the ambition to act as Principal Investigator (PI) in a few preselected science areas. As a part of the Dutch Organisation for Scientific Research, SRON is the national center of expertise for the development and exploitation of satellite instruments in astrophysics and earth system science. It acts as the Dutch national agency for space research and as the national point of contact for ESA programs.
SRON provides 'the ensemble of knowledge and skills, both technically and scientifically, required to perform a principal role in the scientific utilization of space.'

The casestudy

Observations in the infrared, sub-millimeter and millimeter windows are of great importance in astronomy.
It is therefore that the European Space Agency (ESA) built and launched (on May 14th 2009) the Herschel satellite, to explore our universe in those wavelengths.
SRON is the Principal Investigator Institute for one of the three instruments of Herschel, the Heterodyne Instrument for the Far Infrared (HIFI). HIFI will provide us a continuous coverage over the range of 480 to 1250 GHz in five bands and over the range of 1410 to 1910 GHz in two additional bands. However the information of this instrument is spread out over three different webpages

- www.sron.rug.nl/hifi_icc
- www.sron.nl/divisions/lea/hifi
- www.sron.nl → divisions → low energy astrophysics → hifi instr. / hifi science

and it was our assignment to create one website for the HIFI instrument. One website to contain all the information of the three websites, displayed in a structured way. To structure the website we talked to many people from SRON and others (i.e. scientists and students), who could give us more insight in how the website should be structured. This enabled us to create a tree that resembled the structure of the new website. The final result will be shown at

- ww.sron.nl/divisions/lea/hifi

Contactinformatie

De commissie Cookaβurra ’11 bestaat uit de volgende personen:

- Monique Ankoné, *Voorzitter*
- Jelle Blijleven, *Penningmeester*
- Keri Vos, *Bedrijvencommissaris*
- Martine Schroor, *Bedrijvencommissaris*
- Kim van Oost, *Dagprogrammacommissaris*

De commissie is als volgt bereikbaar:

Stichting GBE-FMF
Cookaβurra ‘11
Nijenborgh 4
9747 AG Groningen

Tel: +31 (0)50 363 4948
E-mail: cookaburra@fmf.nl
Website: http://cookaburra.fmf.nl