Maths in the workplace

Richard Browne and Chris Robbins – MEI
Amy Adam - Thales

Overview

- Background
  - MEI Industry programme
  - FMSP Maths at Work events
  - Exemplars
- 3-D Coordinate systems
  - Presentation by Amy Adam, Thales
  - Discussion
- Graph Theory
  - Presentation by Amy Adam, Thales
  - Discussion

MEI Industry programme

- The programme is aiming to get industry to take advantage of MEI's educational expertise in the workplace
- It is also involved in several initiatives intended to enrich mathematics learning by providing information about ways mathematics is used in the workplace

FMSP Maths at Work events

- MEI manages the Further Mathematics Support Programme (FMSP) for the DfE
- FMSP Area Coordinators have provided a number of enrichment events for students in Y10 and Y12 that give them insight into mathematics in the workplace

Exemplars

- The FMSP supports level 3 mathematics learning in the diplomas, particularly the Engineering Diploma
- The Royal Academy of Engineering has provided MEI with funding to develop support material for the Engineering Diploma
- The majority of this effort will be on producing exemplars

Maths at Work Conference

- Typical Programme

9.00-9.30	Registration/Welcome/Introduction
9.30	Session 1
10.30	Break (drinks provided)
10.45	Session 2
11.45	Lunch (visitors to bring a packed lunch)
12.15	Tour of campus – group sizes 10/12
13.15	Session 3
14.15	Break (drinks provided)
14.30	Session 4
15.30–15.45	Plenary session and concluding remarks

I am an Engineer – this is what I do Conferences

- Speakers

Brian Newsome & Lynda Alwood	**Former Research Officer) Former Research Officer) Powergen/CEGB**
Chris Robbins & Claire Sedgewick	**Consultant Engineer, Grallator Student Ambassador, The Dept of Civil Engineering, The University of Sheffield**
Nigel Stephenson & Emma Watson	**Technical Manager) Stress Engineer) Rolls Royce, Derby**
Rik Stewart & Jolene Costello	**Senior Design Engineer) Jacobs, Senior Engineer, Transport and Development) Nottm.**

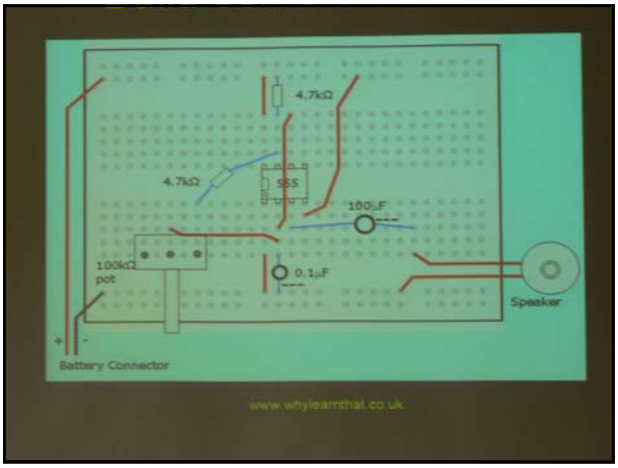
Maths at Work Conference

- Speakers – key issues
  - What they intend to do
  - How they will do it:
    - Well structured presentation important
    - An interactive approach is essential
  - Pitching the presentation at the correct level:
    - Presenters need to be made aware of the participating students' current mathematical abilities

Exemplars

- MEI's work on exemplars will be carried out by Chris Robbins
- Chris has been a longstanding contributor to the Maths at Work initiative
- He also contributed to a conference MEI held with the Institution of Engineering and Technology last year

MEI
Mathematics in Education and Industry
Innovators in Mathematics Education



I am now delighted to introduce

Amy Adam

MEI

THALES

MEI Conference July 2nd 2010

Mathematics in the Defence Industry – 3D Coordinate Systems and Graph Theory

Land Defence

Background

Amy Adam

- Education –
  - Mathematics and Statistics BSc
  - Ongoing part-time MSc in Digital Signal Processing
- Industry –
  - Modelling and Algorithms Engineer with **Thales Missile Electronics** (2008 –Present).
  - Primarily defence research and de-risking activities.

THALES

Application of Topics in the Defence Industry

- 3D Coordinate Systems
  - Practical Use
  - Terminology
  - Software Generated Simulation
- Graph Theory
  - Programme Management
    - Task Breakdown
    - Resource Allocation
    - Budgeting
    - Risk Analysis

THALES

3D Coordinate Systems

THALES

Practical Use

- Aviation Metrics
- Weapon Guidance Systems
- Navigation
  - Naval
  - Aerospace

These technologies all rely on a standardisation of axes systems

➢Unfortunately the academic and the engineering definitions don't always match!

THALES

3D Coordinate Systems - Terminology

- In the classroom

Visualisation can be tricky when linking from 2D to 3D

[σ ,θ, ψ] abstract context

- What direction are we rotating in?
- Is it a left-handed system or a right-handed system?

- In industry

3D visualisation tools

Descriptive angle and axes definitions

elevation

yaw

heading

radians

pitch

bank

roll

N

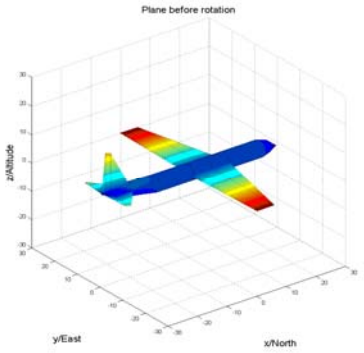
W E

S

degrees

THALES

Rotation Simulation



THALES

Rotation Simulation

There will be a few slides showing the plane rotating.

I haven't managed to get the video files in a compatible format yet but it won't be a problem

THALES

3D Infrared Imaging

Double Click to play!

Software code triggers the mechanics of the gimbals.

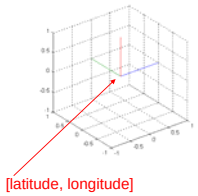
THALES

The issue can get complicated very quickly!

Start with a global frame of reference. Where the origin is a convenient latitude, longitude

We have seen the plane rotating on this axis

We may have a sensor rotating in on the plane's axis



What is the 'plane's axis'?

Links nicely to cross products, basis and orthogonallity.

THALES

The Programme Management Plan balances –

Task Breakdown

Resource Allocation

Budgeting

Risk Analysis

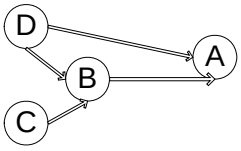
THALES

Graph Theory

- Abstract Context

Task A depends on completion of tasks B and D

Task B depends on completion of tasks C and D



- Programme Management

Vast network of task completion dependencies

Tasks are also constrained by –

- Start and finish times
- Duration
- Availability of resources

Applying software like Microsoft Project Planner provides a top level view of the project

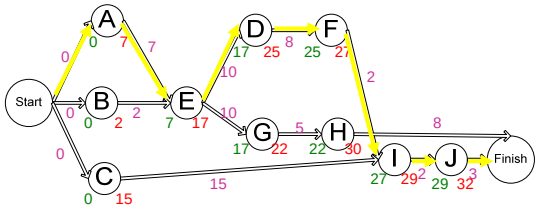
THALES

Graph Theory in Action

- Sound project management greatly increases efficiency and can save the project budget millions on large scale projects.
- The critical path is the driving force of a project. Once we have a task dependency breakdown we identify this path.

Task breakdown Example

Critical Path – The Maths



How can we introduce this into the classroom

- Pupils need to be aware of the advantage maths gives them in industry –
  - Engineers employed by Thales are sourced from a wide range of disciplines.
- Software tools
- Interaction between departments such as physics, chemistry and design.