University of Nottingham
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MMME2044 Group Design & Make

Air Motor

Clinic session for PDR

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Outline of session

The purpose of the PDR clinic session is

- to give an overview of PDR pro-forma
- to recap creative design methods from 1st year and their use in PDR submission
- *to update information from RAP's press statement* ***(to a later date)***
- to clarify and discuss general and specific questions
- to **get feedback** of your **MMME2044 learning and activities**

Preliminary Design Review (PDR)

Preliminary Design Review (PDR) is a key stage of the whole design process and normally performed at the end of conceptual design

- to present possible concepts, methods of evaluation and rationale of chosen concept
- to present a refined design with initial assessment of preliminary calculations
- to report on team working and plans for next stage of project

Note: PDR is a formative submission

What should be included in PDR submission?

- **A single group report in PDF format submitted on Moodle by 3pm, Friday, 28th October**
- **A PDR check list** and **PDR pro-forma** are available in the **Group D&M project folder** in the **Design Tutorial and Support** section on Moodle
- **PDR report should include (in PDF format)**
  - Completed PDR checklist (1 page per group)
  - Statement of Requirements (1 page per group)
  - Concept generation with annotations (1 page per student)
  - Morphology chart (1 ½ pages per group)
  - Concept selection (2~3 pages per group)
  - Summary and plan of Team working (2/3 page per group)
- **A typical PDR report is between 10~15 A4 pages**
- Use the name **"PDR_Group number"** in submission, e.g. "PDR_Grp22.PDF"

Methods for concept generation

Prof Geoff Kirk will give a recap on **Creativity and Concept Generation**. The lecture slides can be accessed from the link to **1st year MMME1024 module**

- **Brainstorming**

  A commonly used group creativity activity for concept generation

- **Analogy**
  - A way to identify and use similarities in forms, features and other characteristics of one solution to solve another design problem
  - Search for relevant information from various sources may be a good start

- **Morphology chart**

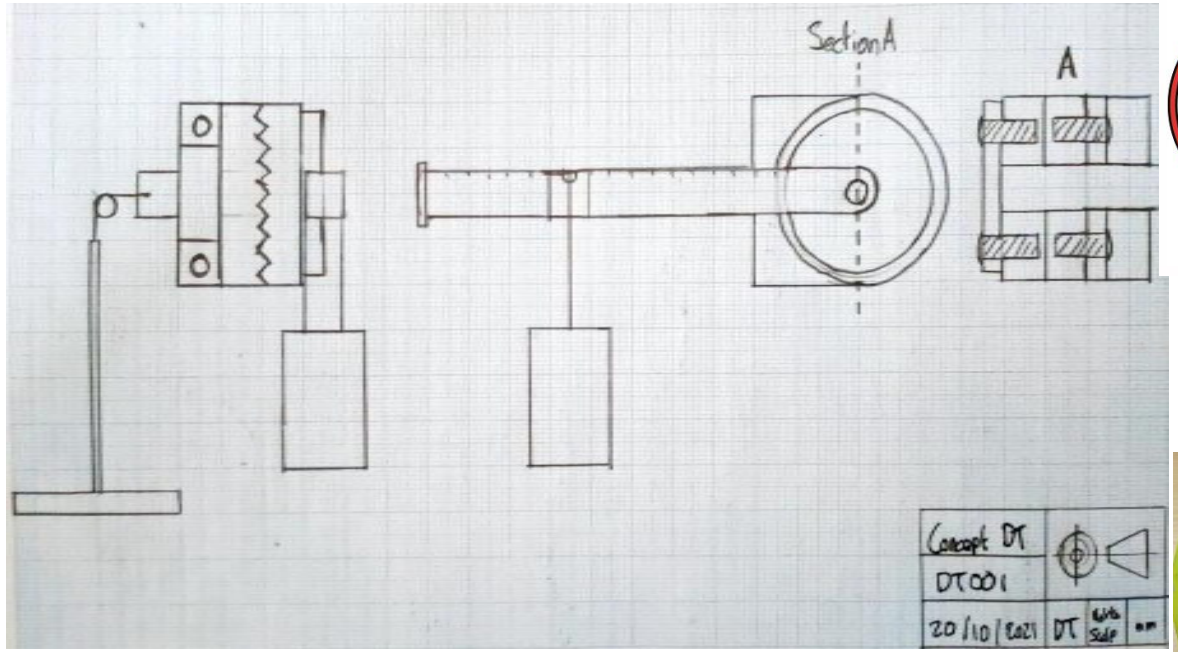
  A useful method to identify key enabling functions and possible solutions. Various combinations or mapping could lead to an optimum solution

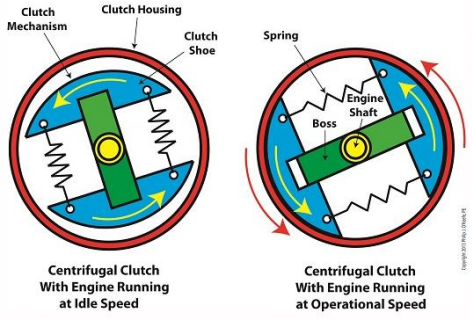
Methods of concept/design presentation

- **A hand sketch (or stick diagram) with annotations** is an efficient means to
  - capture ideas,
  - identify key components,
  - define a general layout and working mechanism.
- A scaled **embodiment sketch/drawing or a simple Solidworks assembly model sections or views** is useful means to show the overall layout and assembled components of some details.
- ***A complete set of GA (General Assembly), detail drawings*** *and Solidworks CAD assembly/part models plus other documents, e.g. report, calculation/evaluation data are the official outcome and documentation of a design for production and handover to customers* ***(only for CDR submission later)***

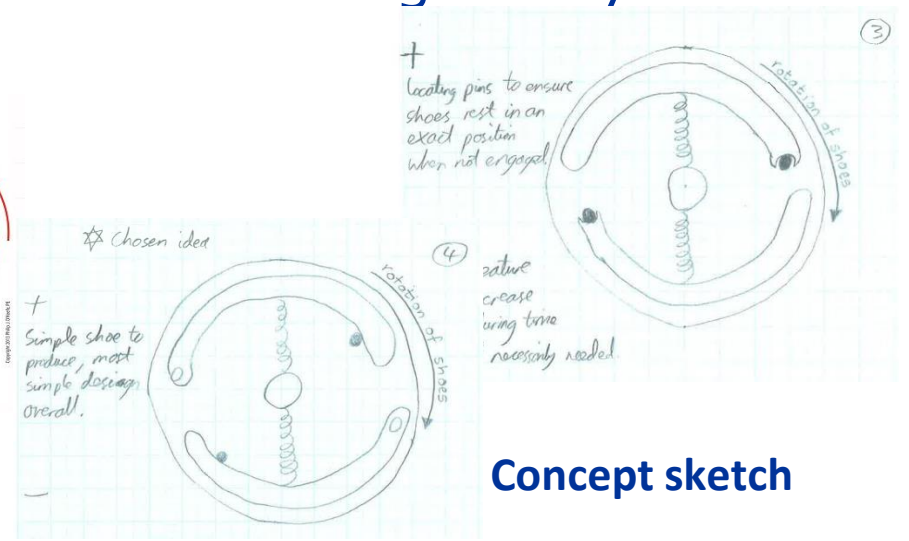
Examples of Embodiment sketch

- **Embodiment sketches** show a general layout and overall sizing of key components in more details of a chosen concept.

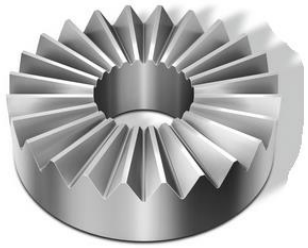


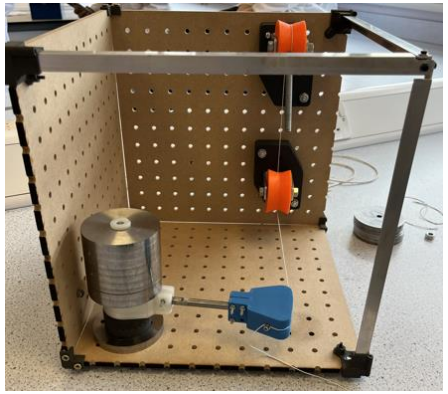


Group D&M Centrifugal clutch

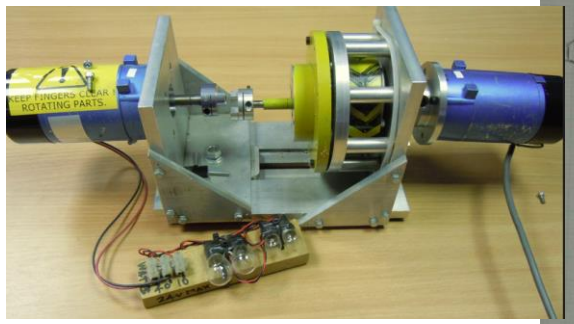


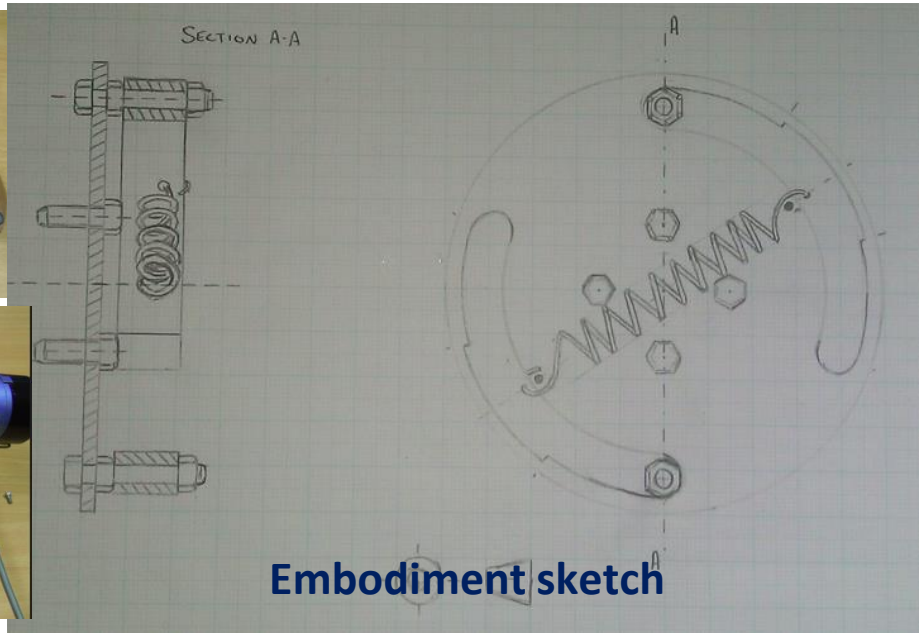
Concept sketch





Group D&M Test rig of Hirth Coupling (21-22)





Embodiment sketch

Team working

- Successful completion of the Group Design and Make (Air Motor) project **requires efficient communication and team working, individual effort and good planning.**
- The PDR report include a **summary on Team working** on
  - group work and individual contribution to PDR
  - a plan for CDR submission
  - any issues for your Design Tutor's attention
- Use of the **Air Motor Task List** available in Design Tutorial and Feedback section on Moodle can be a useful means for record keeping, project management and actions. Its use can be used as evidence of good team working and individual effort in CDR submission.

Feedback

- **General feedback will be provided by your tutor**
  - **Satisfactory** - The deliverable was achieved on time to a **satisfactory standard** – you can proceed with your selected design.
  - **Category 1 Deficiency** - The deliverable was not achieved or there was a **major deficiency**. The deficiency needs to be addressed in a timescale.
  - **Category 2 Deficiency** - The deliverable was achieved but there was a **minor deficiency** to be addressed within an agreed timescale.
  - **Observation** - Items that are acceptable but **can be improved**.

- Additional feedback on the presentation, quality and clarity of contents of the PDR report and possible areas for improvement

Calculation and modelling

➢ Piston force, torque and power equations

$F = p \times A$

where, F - force (N)
p - pressure (Pa)
A - area (m^2)

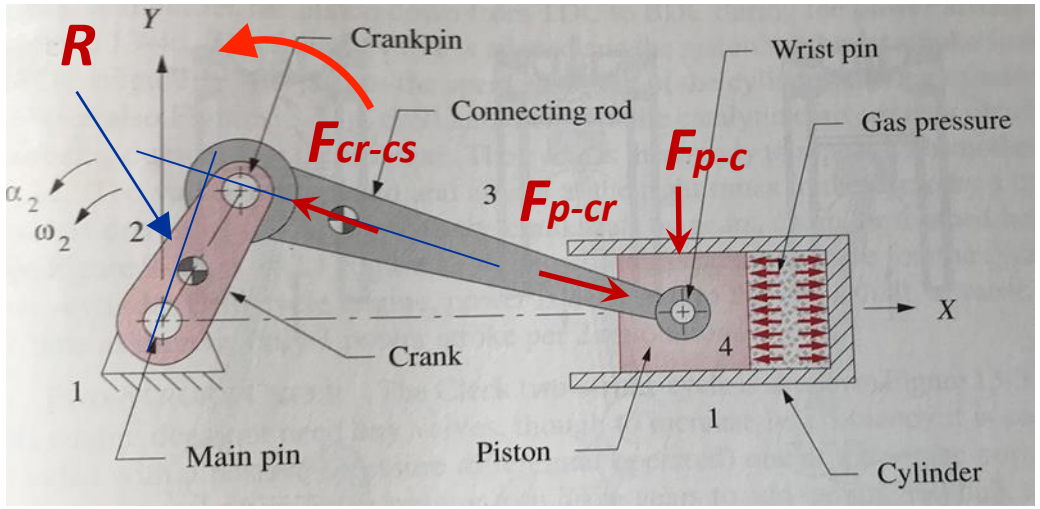
$P = T \times \omega$

where, P - Power (W)
T - Torque (Nm)
ω - Rotating speed (rad/s)

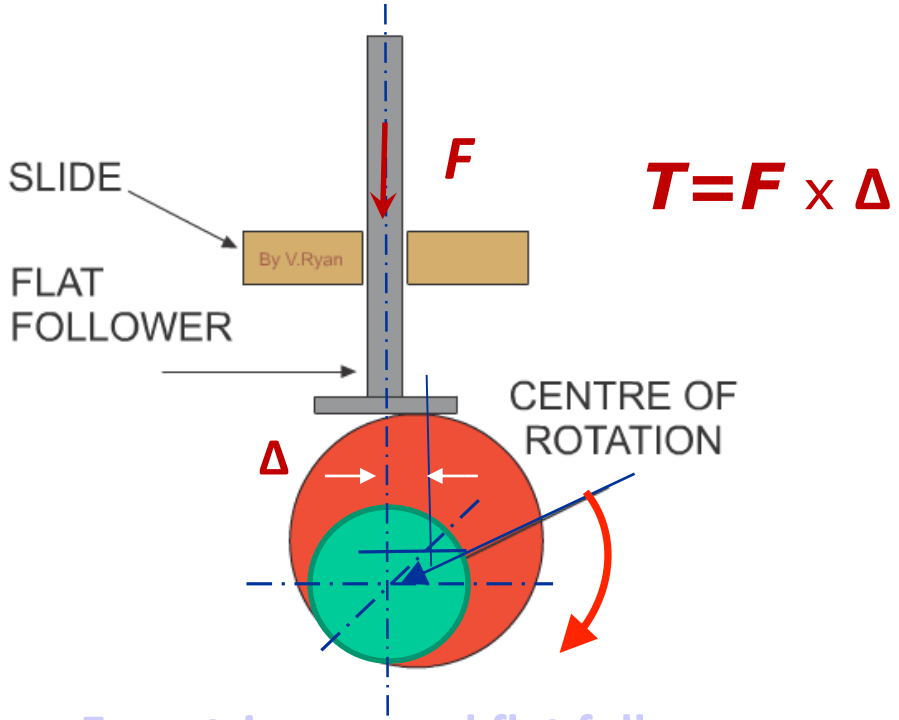
$T = F \times R$

where, T - Torque (Nm))
F - Force (N)
R – Torque arm (m)

$T = F_{p\text{-}cr} \times R$



A slider-crank mechanism



Eccentric cam and flat follower