

thinkMOTION is funded by :



Conférence AIP PRIMECA 2011,
29 Mars – 1er avril 2011, Mont-Dore, France
Plénière P7 : Projet ThinkMotion : Développement d'une
bibliothèque de machines et mécanismes

Session plénière 7

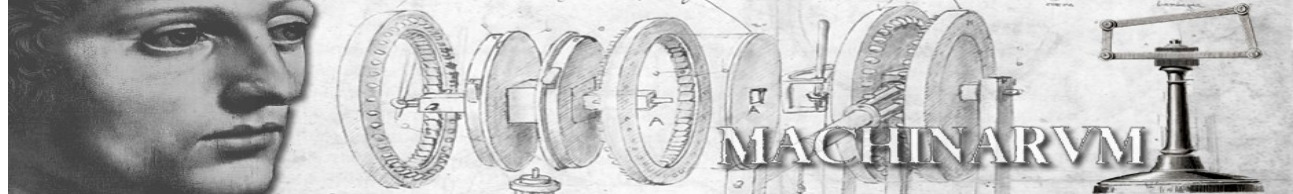
thinkMOTION

Bibliothèque de Machines et de mécanismes

1. **Présentation du projet européen thinkMotion**
Ulf DÖRING, Torsten BRIX
Université Technologique d'Ilmenau
2. **Présentation du projet national PATSTEC**
Catherine CUENCA, Daniel THOULOUSE
Université de Nantes, Musée des Arts et Métiers-CNAM
3. **thinkMOTION, Stratégie de déploiement en France**
Jean-Christophe FAUROUX, Richard COUSTURIER
IFMA



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Conférence AIP PRIMECA 2011,

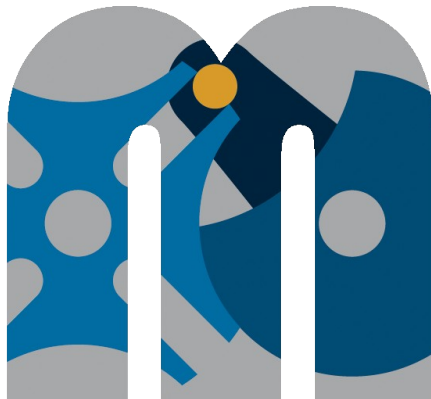
29 Mars – 1er avril 2011, Mont-Dore, France

**Plénière P7 : Projet ThinkMotion : Développement d'une
bibliothèque de machines et mécanismes**

thinkMOTION

European Project

Deployment strategy in France



thinkMOTION

Jean-Christophe.FAUROUX@ifma.fr

Richard.COUSTURIER@ifma.fr

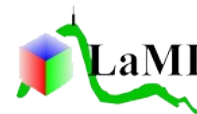
Clermont Université

Institut Français de Mécanique Avancée (IFMA)

EA3867, FR TIMS / CNRS 2856

Laboratoire de Mécanique et Ingénieries (LaMI)

BP 10448, F-63000



The French Team in March 2011

Coordinator FR + Contributor

- IFMA (French Institute for Advanced Mechanics)
<http://www.ifma.fr>



Libraries

- BCU Library (Clermont-Communauté Library)
<http://bibliotheque.clermont-universite.fr>
- CEMAGREF Library
<http://cemadoc.cemagref.fr>



...

Museums

- PATSTEC Auvergne
www.patstec.fr
- ... (other contacts in process)

PATRIMOINE scientifique et technique contemporain

Universities

- Blaise Pascal University
www.univ-bpclermont.fr
- ... your university ?



Labs

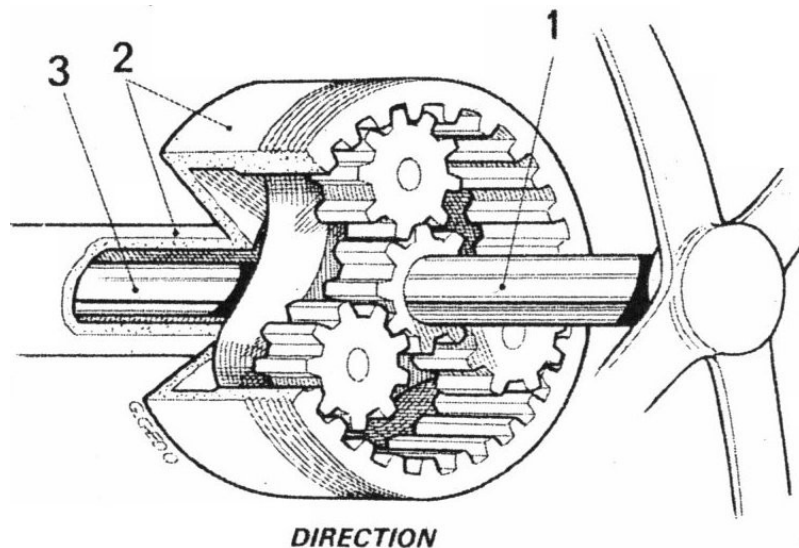
- LaMI
www.ifma.fr/lami
- ... your lab ?



Contribution from the BCU Library

People and tasks

- Librarians for selecting books
- A part-time technician for scanning books
- Several projects on digital libraries
- Important collections of old books on mechanical and civil engineering (more than 180000 pages)
- Full text and separate images

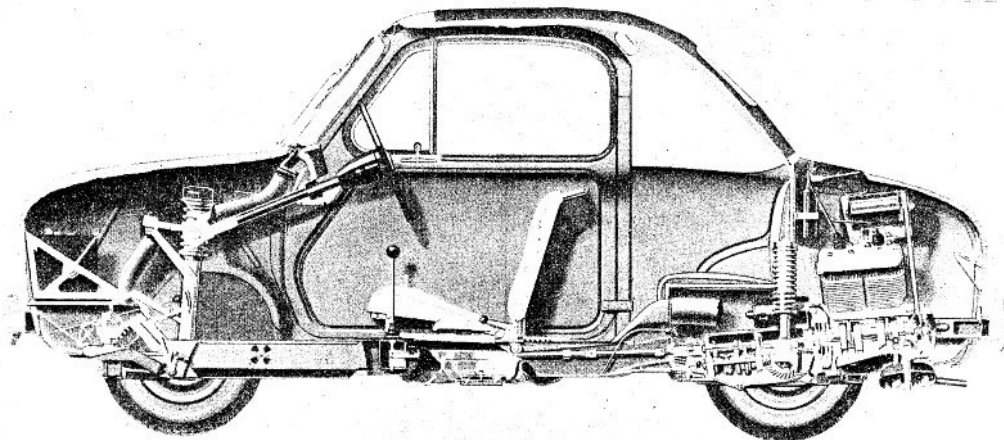
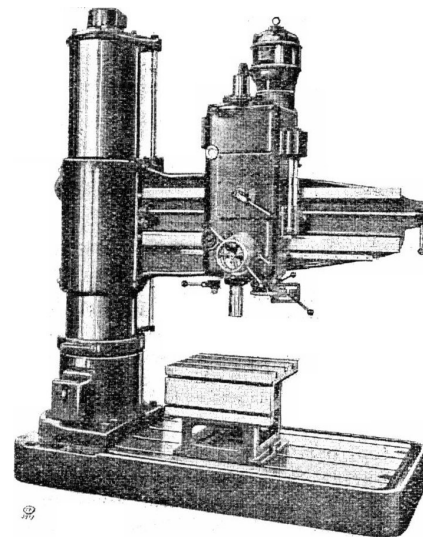
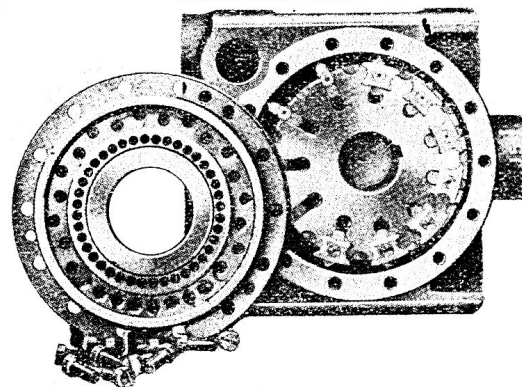
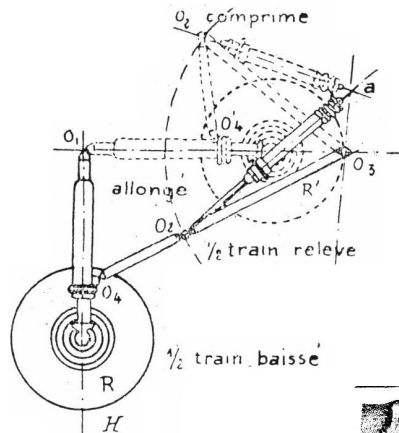
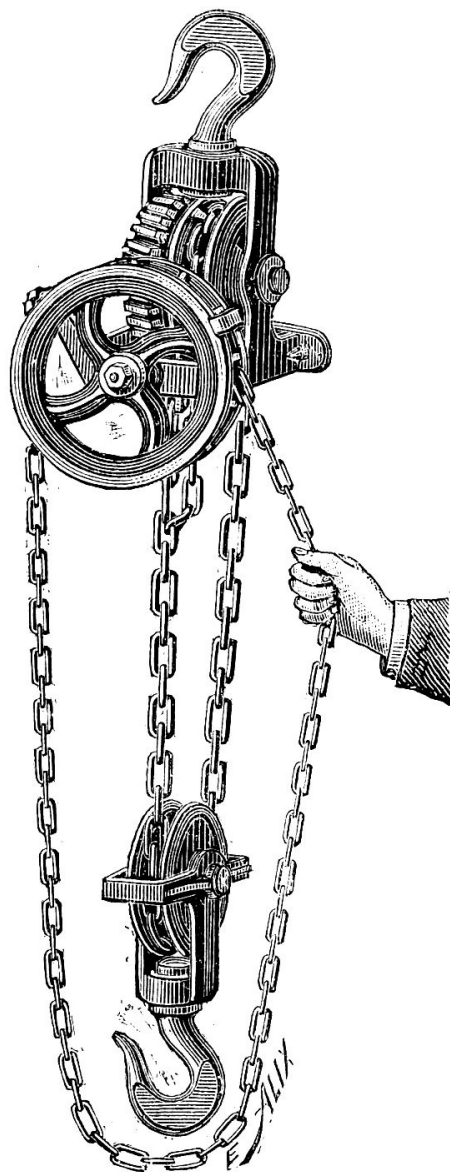


Hardware

- Book scanner Zeutschel OS12000 HQ
- Flat A2 format,
- 15 seconds for A2 Color 600 DPI
- Thickness / curvature compensation



Contribution from the BCU Library



Contribution from the CEMAGREF Library

People and tasks

- Librarians for selecting books
- Exchanges with the central CEMAGREF library at Anthony
- Books and journals about agricultural machines



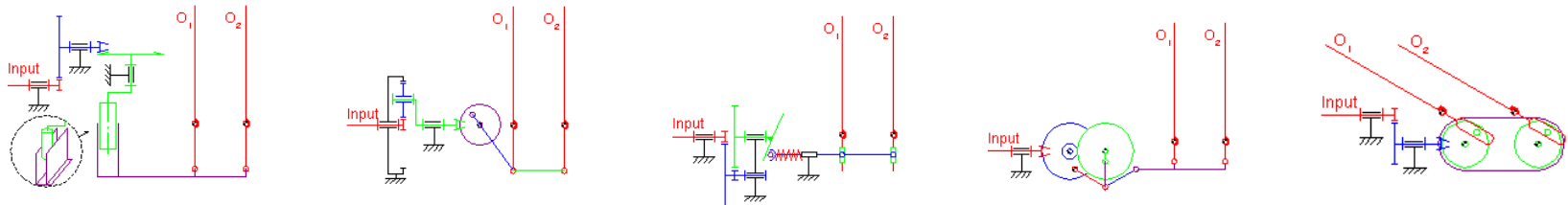
Contribution from IFMA

People and tasks

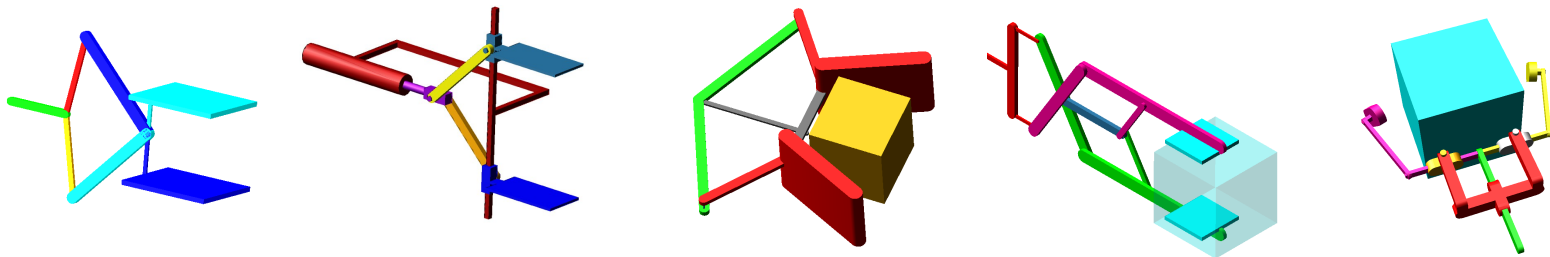
- IFMA, French Institute for Advanced Mechanics (1991)
- Around 180 students per promotion x 4
- 3 departments
 - Materials and Structures (St2M)
 - Machines, Mechanisms and Systems (MMS)
 - Industrial Engineering and Logistics (SIL)
- Already working on educational projects about machines
- Software : Adams and Catia V5



2003 – Mechanism for a windscreen wiper

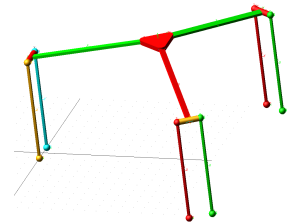
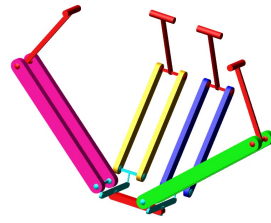
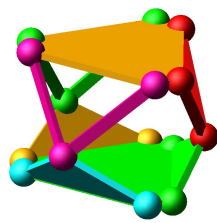
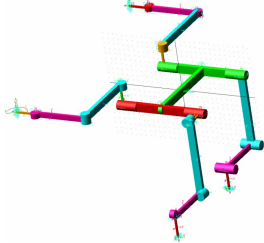


2004 – Two-finger robot hands

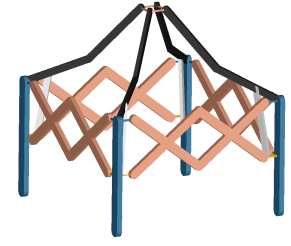
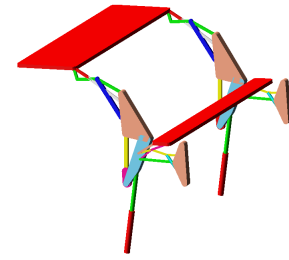
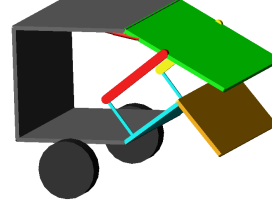
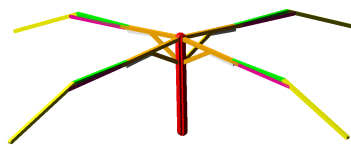
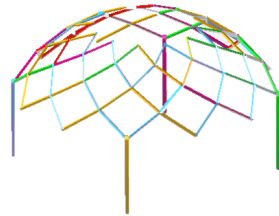


Contribution from IFMA (cont.)

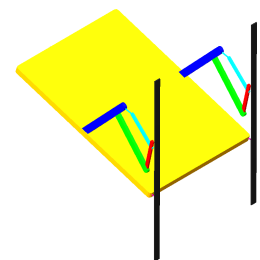
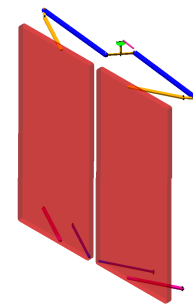
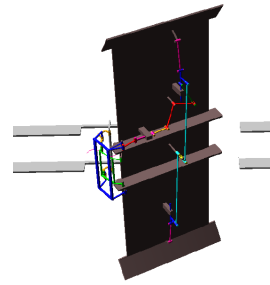
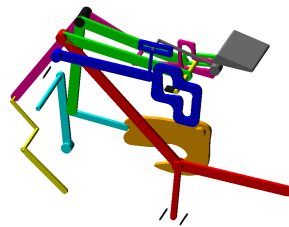
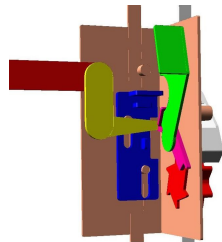
- 2005 – Parallel robots



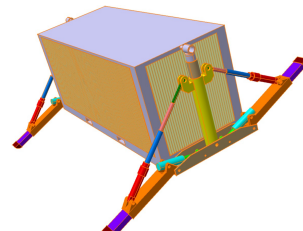
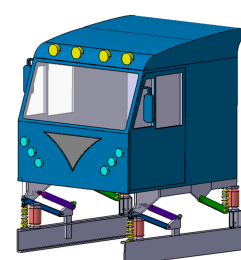
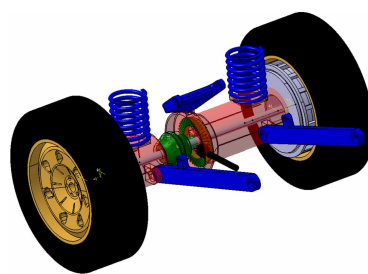
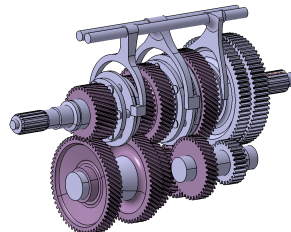
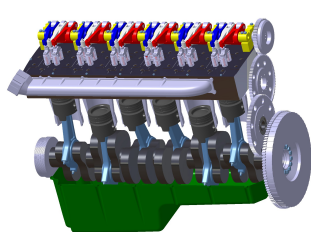
- 2006 – Foldable mechanisms



- 2007 – Doors and latches



- 2008 – Elements of trucks



Contribution from IFMA (cont.)

A federating project at IFMA

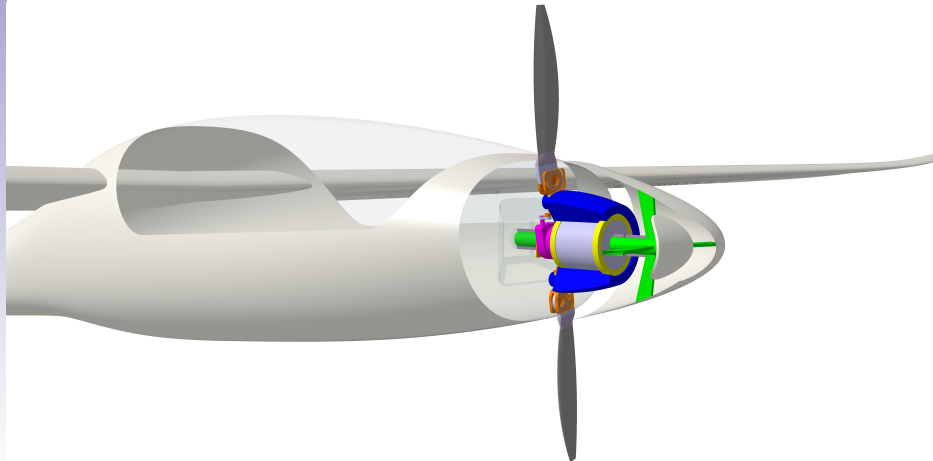
- Various contributors
- Adaptation to each type of lecture
- **First** : Educational content
- **Second** : Interest for thinkMOTION

Tous pôles	Flux	Sujet
S3-Conception et Fabrication Assistée par Ordinateur	160 élèves	Dessin/Cinématique
S1-S2-S3-Anglais (CIME)	160 élèves	Traduction (machines, biographies)
Projet 2A	160 élèves	Etat de l'art (cassage noix, joug rugby...)
PIFE	160 élèves	Etat de l'art selon sujet
Pôle ST2M	Flux	Sujet
S4-Dimensionnement des structures et assemblages	24 élèves	Dimensionnement de parapluies
Pôle MMS	Flux	Sujet
S3-Ingénierie Assistée par Ordinateur	72 élèves	MEF / Optimisation de mécanismes
S3-Modélisation des Robots	72 élèves	Robots manipulateurs anthropomorphes
S4-Analyse et Synthèse de Mécanismes	48 élèves	Mécanismes parallèles hyper/isostatiques
S4-Analyse de Brevets	72 élèves	Machines
Pôle SIL	Flux	Sujet
S3-Robotisation et Automatisation	48 élèves	Robots industriels, convoyeurs
S3-Industrialisation et Mise en Production	48 élèves	Transitique

Creating a CAD exercise for thinkMOTION

CAD Exercise Rules

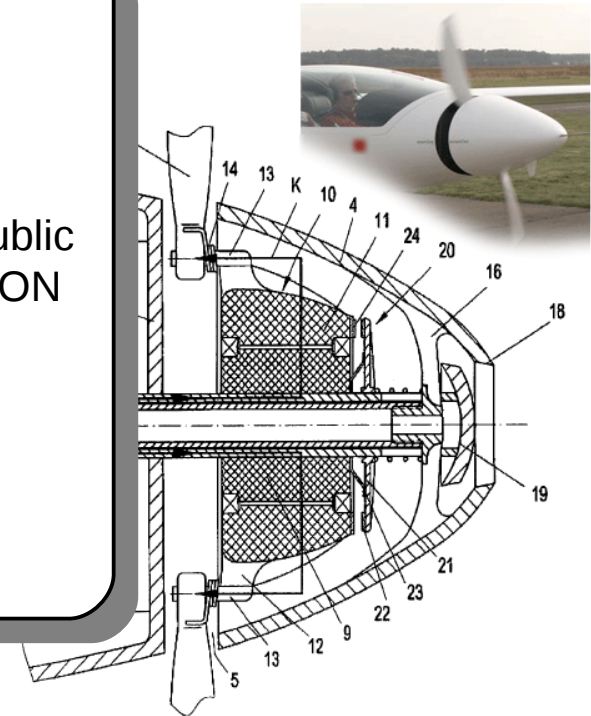
- Choose a patent (patents are free of copyright)
 - Understandable and **interesting**
 - Not too complex ($\approx 10-20$ parts)
 - With realistic shapes (for CAD interest)
 - From a European inventor
- One mechanism / One student $\rightarrow$ uniqueness $\rightarrow$ public claim on a Moodle forum + checking the thinkMOTION database
- Modeling / Parametrizing / Assembling / Animating
- Output :
 - CAD assembly (.ZIP)
 - Screen capture (.PNG)
 - Video (.AVI)
 - Mechanism description (form)



Re: Forum Travail de TP et projet thinkMotion
par LOUIS Nicolas, samedi 13 novembre 2010, 10:55

N° Brevet : US6550719B2

ive device for aircraft



[Niveau supérieur](#) | [Modifier](#) | [Supprimer](#) | [Répondre](#)



Re: Forum Travail de TP et projet thinkMotion
par COUSTURIER Richard, lundi 6 décembre 2010, 16:45

validé

[Niveau supérieur](#) | [Modifier](#) | [Supprimer](#) | [Répondre](#)



Re: Forum Travail de TP et projet thinkMotion
par MENAND Alexis, samedi 13 novembre 2010, 18:18

MENAND Alexis, MMS3B

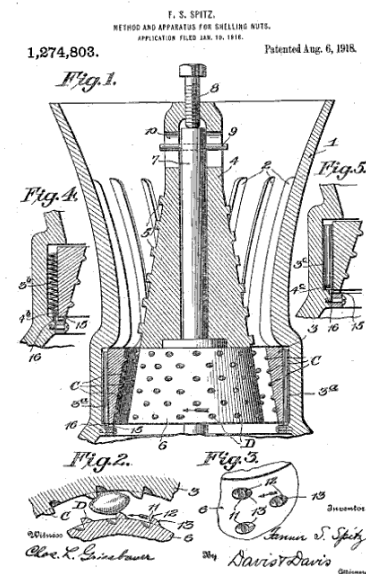
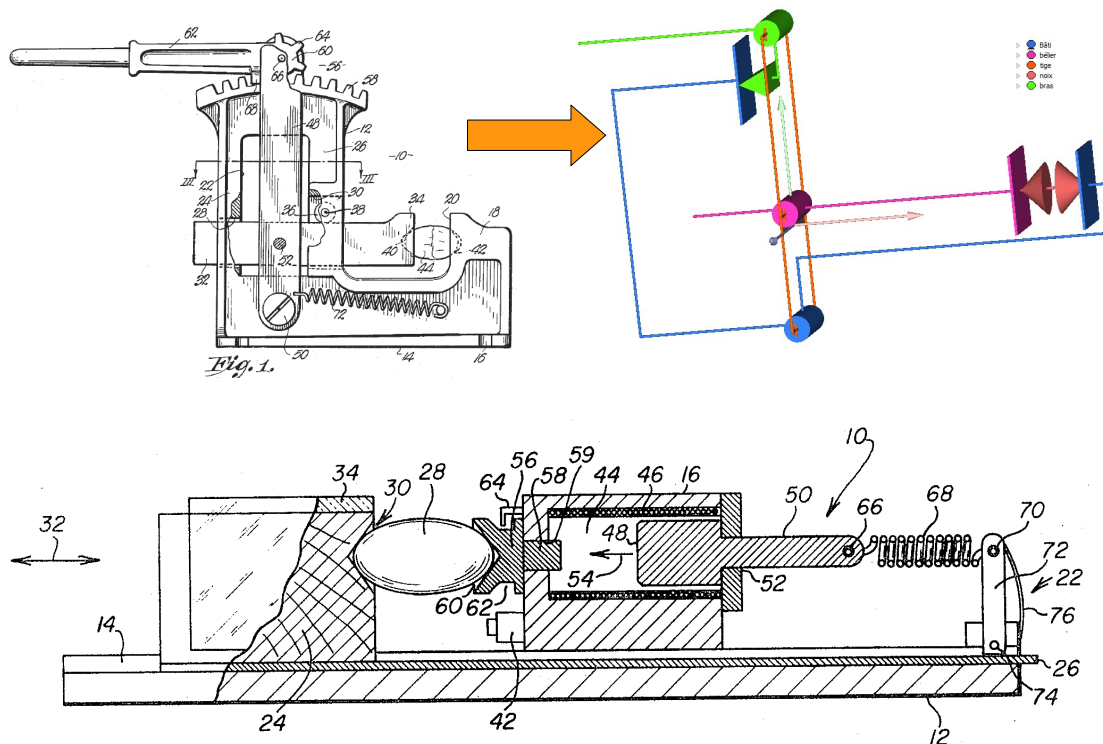
N° Brevet : FR2602474A1

Titre : Windscreen wiper unit for vehicle

A student design project for thinkMOTION

Design project

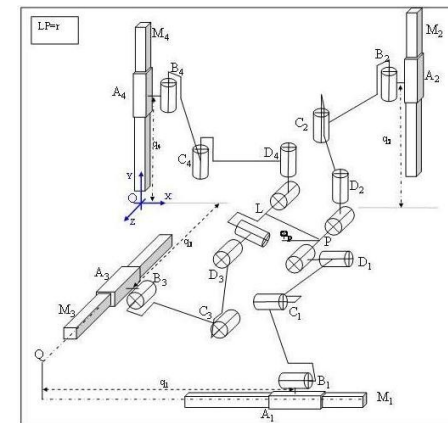
- Ex : design project in 2nd year → 12 students
- “Creating a crushing machine to extract argan nut” (K. Kouiss)
- Study of **existing crushing machines**
- **Patent research** on nut crackers / Market study
- Output :
 - Picture (.JPG)
 - Kinematic chain (vector format)
 - Mechanism description (form)



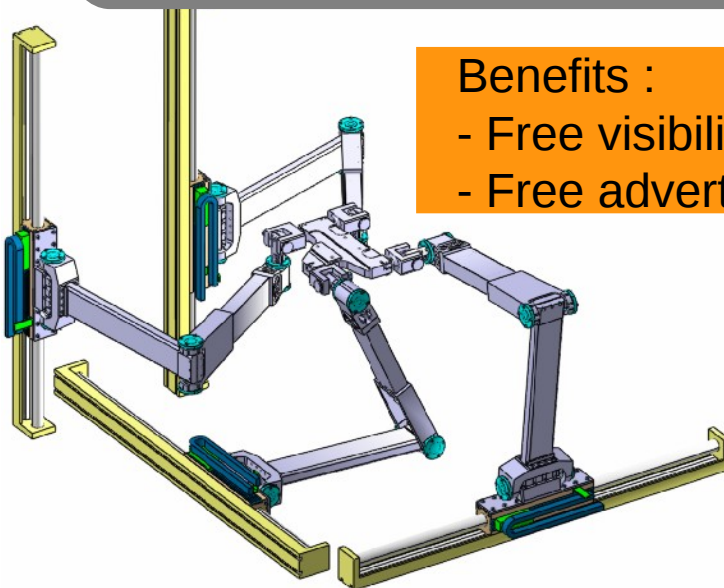
Contributing as a lab

Rules

- **Input:**
 - Your prototypes
 - Your machines / mechanisms / robots
 - Your patents
- **Output:**
 - Text of patent (.PDF)
 - Mechanism description (form)
 - CAD image (.PNG)
 - CAD video (.AVI)
 - Photo of prototype (.JPG)
 - Video of a real demo (.AVI)

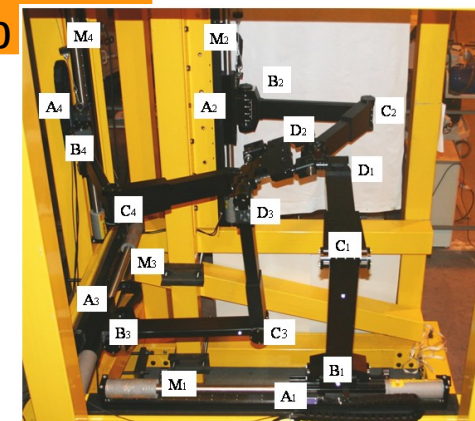


Ex : Isoglide parallel robot
IFMA/LaMI



Benefits :

- Free visibility for your research work
- Free advertisement for your lab



Contributing as a school or university

Rules

- Input:

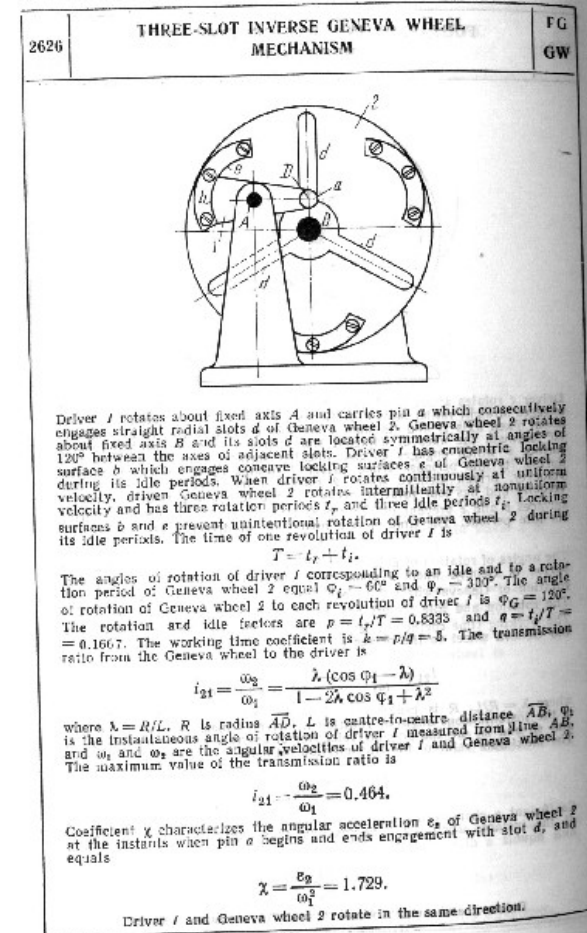
- Patents
- Documents without copyright (old or free)
- Documents with copyright describing machines that you re-model with the students

- Output:

- CAD model
- Mechanism description (form)
- CAD image (.PNG)
- CAD video (.AVI)
- Photo made by you (.JPG)
- Video made by you (.AVI)

Benefits :

- Mention of each student name → Motivation
- Free advertisement for your university



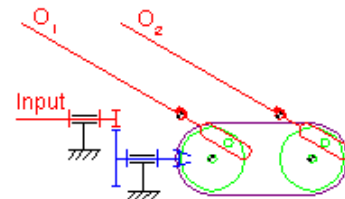
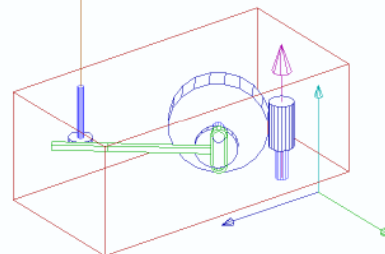
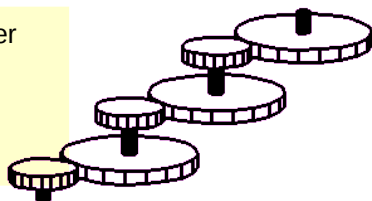
Ex : Re-modelling all the 6000 mechanisms of the book :
I.I. Artobolevski
Les mécanismes dans la technique moderne (Mir, 1975, 7 tomes, 5120 pages)

Future extension to Research

● Examples of interesting design methods

Approach 1: Serial combination of blocks of mobility m to obtain a mechanism of mobility m

Example: adding one after the other several stages for transmission movement, such as in CASYMIR software [Fauroux99] [Wahl03] [Fauroux Bouzgarrou Gogu 04]



Approach 2: Serial connexion of blocks to obtain a higher mobility

Example: serially adding $N \times$ (part with a joint) to generate all the anthropomorphic robot arms of a given DOF. Evolutionist algorithms may be used [Gogu07]



Approach 3: Parallel connexion of blocks to obtain a mechanism with smaller (or equal) mobility

Example: design of parallel robots of n DOF, $n \in [2,6]$ by combining legs with $\text{DOF} \geq n$ [Gogu07]

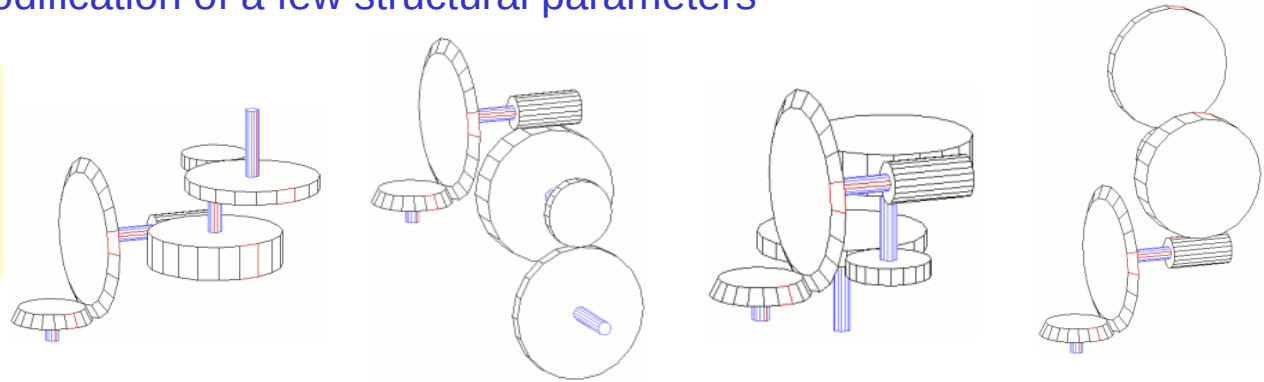


Future extension to Research

● Examples of interesting design methods (continued)

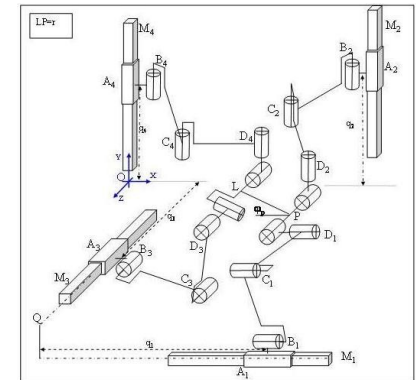
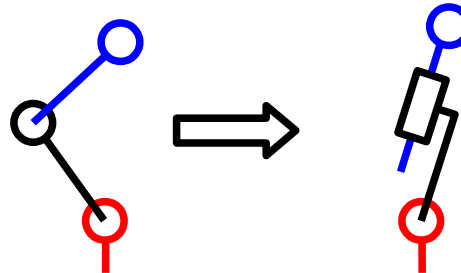
● Approach 4: Modification of a few structural parameters

Example: changing the output direction of a transmission mechanism by adjusting only the inter-stage angles [Fauroux 2002]



● Approach 5: Substitution of a part of a mechanism

Example: replacing a folding leg by a prismatic leg of the same mobility in a parallel robot of the Isoglide family



● Approach 6: Inference based on existing mechanisms

Example 1: from {Mechanism M1 with property P1, Mechanism M2 with property P2}, it is possible to design M3 with both P1 and P2

Example 2: from {Mechanism M1 with property P at level L1, Mechanism M2 with property P at level L2}, it is possible to design M3 with property P at level $L1+k(L2-L1)$ with $k \in [0,1]$ (level interpolation)

● Approach 7: Changing the input link / output link in a mechanism...

Conclusion : thinkMOTION...

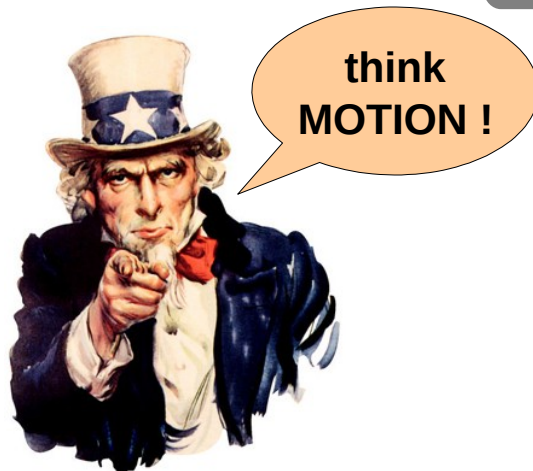
...has Educational objectives

- **Digitizing** and **organizing** a huge content on machines and mechanisms
- Technical and cultural **heritage** from Europe
- **Free access** for all from the digital European library www.europeana.eu



...has long term research potential

- Reflection on a **neutral file format** for mechanisms
- **Taxonomy** of machines
- Innovative **design methods** by intelligent re-use of knowledge (methodology and CAD aspects)



...needs you !

- As a **teacher**, with your **students**
- As a **researcher**
- Because it is a huge and ambitious goal that requires help from every volunteer and **will be continued** after this project

Every contributor will be cited by name/URL