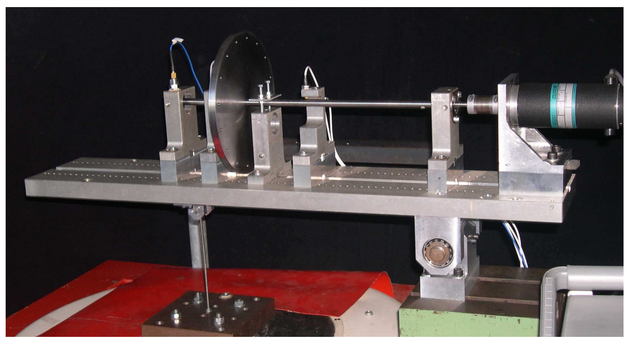
LaMCoS, CNRS UMR5259

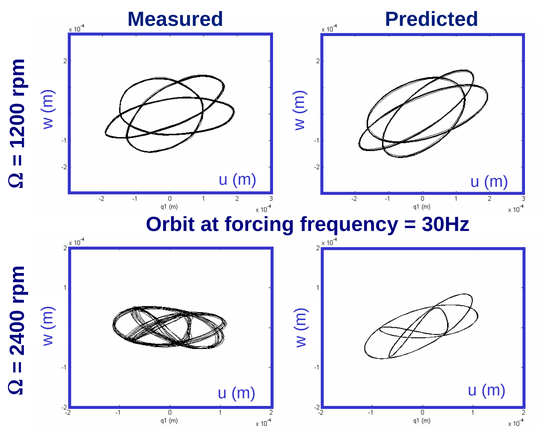
Dynamics & Control of Structures

Research activities

- Prediction & control of the dynamic behaviour of structures fixed, rotating, or moving.
- Smart structures & machines: systems with means of observation, analysis and control to respond to any operational situation expected or unexpected.
- Models & experiments to analyse phenomena, identify parameters and validate computer codes.
- Analysis of effects of rotation, strong localized and distributed non linearities, uncertain and variable parameters, stresses and dissipations, non-stationary states, multi-physics and interactions with the environment.

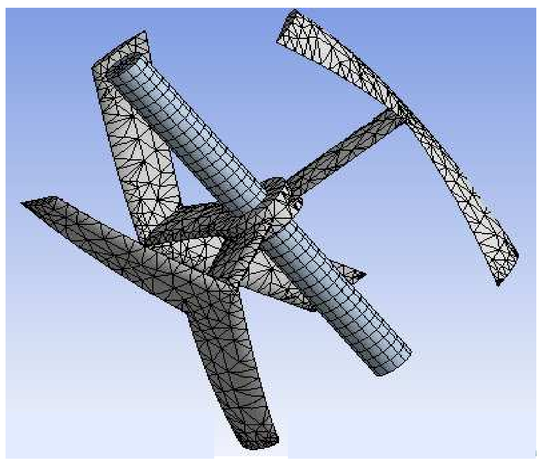


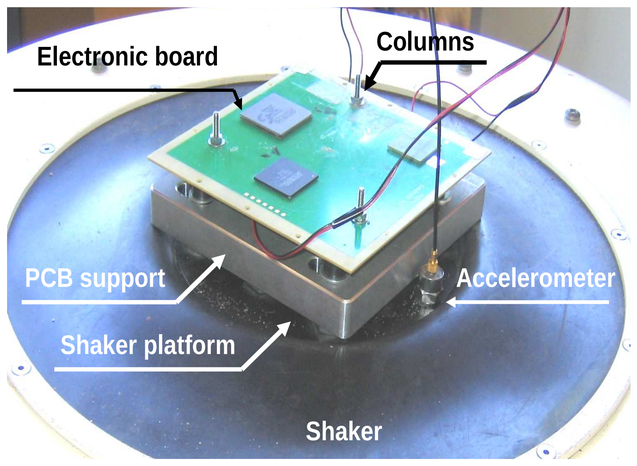
On-board rotor subject to base excitation



$$\mathbf{M}\ddot{\mathbf{x}} + \mathbf{C}\dot{\mathbf{x}} + \mathbf{K}\mathbf{x} + \mathbf{K}_p\dot{\alpha}^2\mathbf{x} = \mathbf{f}_1\dot{\alpha} + \mathbf{f}_2\ddot{\alpha} + \mathbf{f}_3\left(\dot{\alpha}^2 Z - \ddot{Z}\right)$$

Water turbine module

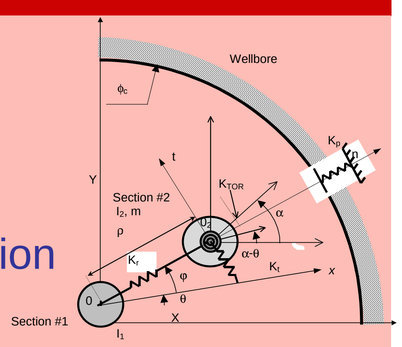




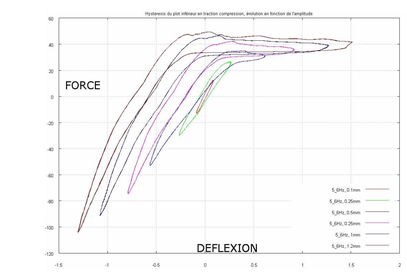
Active control of electronic boards

Scientific expertise

- FE, modal, condensation methods
- Rotor dynamics. Multi-body dynamics
- Multi-physics modelling
- Active & passive control techniques
- Identification, optimisation, homogenisation
- Inverse problems. Data completion
- Non linear techniques.
- Dynamic stability analyses: trajectories, instability chart, bifurcation, route to chaos…
- Diagnostic techniques. System Health Monitoring.

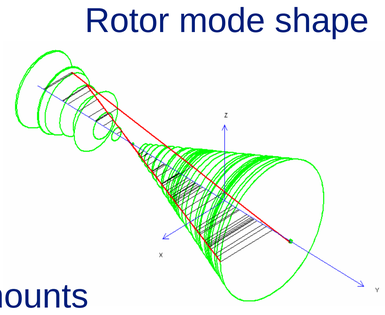


Phenomenological model



Force deflection loops of mounts

Rotor mode shape



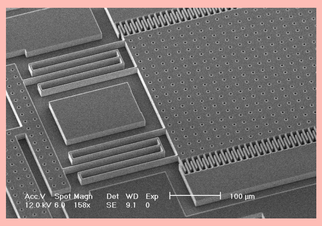
Trajectory stability

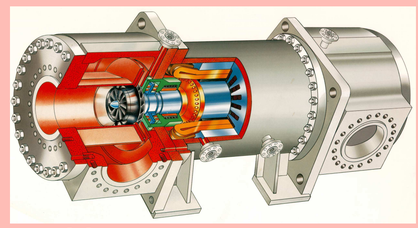
Industrial applications

- Energy transformation: turbine, alternator, compressor,…
- Transport: aircraft, helicopter, vehicle
- Equipment: optic instrument, sensors,…

Helicopter: transmission shaft

M/NEMS sensor

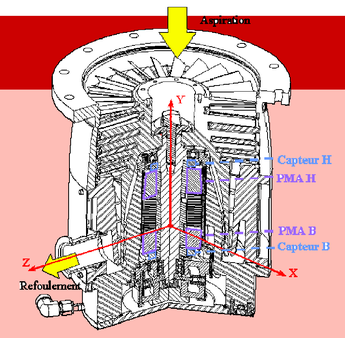




Moto-compressor on Active Magnetic Bearings

Industrial benefits

- Innovation
- Reducing costs & nuisances
- Increasing & optimising performances :
  - Efficiency, comfort
  - Downsizing, reliability, safety
  - Sustainable development



Vacuum pump on AMB

Staff

- 15 Faculties: Professors & Associate Professors
- 4 Engineers, Technician & Administrative
- 15 PhD students
- 10 Prags, internship & visiting researchers

Scientific skills

- Model & software development
- Design test benches
- Data acquisition systems
- Test performances

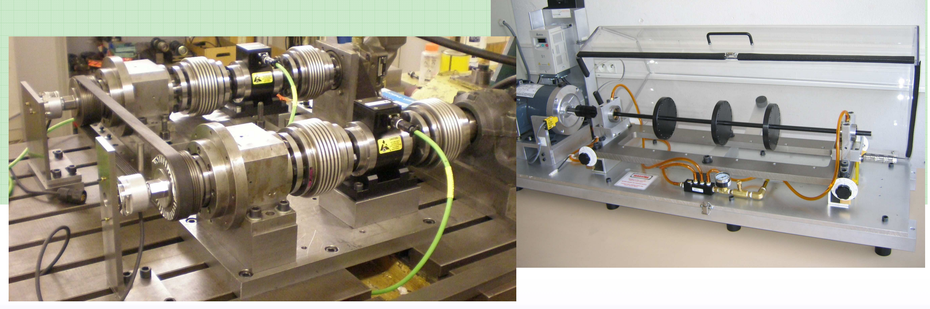
Main industrial & academic partners

- Alcatel VT, Areva Jeumont, Converteam, Danfoss, EDF R&D, GE Oil & Gas, Honeywell TT, Leroy-Somer, Maïa Eolis, Microturbo, RITEC, Technofan, Turbomeca, Tecumseh Europ, …
- JTEKT, PSA, Renault, Valéo, Renault Trucks, NTN-SNR,
- EADS-Eurocopter, EADS- MBDA, Thalès Alénia Space
- Babolat, CEA-LETI, CETIM, CT du Cuir, Salomon, Vibratec,…

- Auburn Univ., Ohio State Univ., UF Uberlandia, LIGO Lab (MIT & Caltech), …
- EC Lyon-LTDS & INL, ENTPE-DGBM, FeMTo-LMA, IFMA-LAMI & LIMOS, INPG-LEGI & 3SR, INSA Lyon–LGEF, LVA & Ampère, LCPC-LAMI, UTBM-M3M…

Specific facilities

- Test benches: rotors, car drive line, transmission,…
- Software for measurement analyses & prediction
- Laser velocimeters, optoelectronic sensors, digital cameras
- On-board multi-channel acquisition systems
- Temperature & humidity control chamber
- Electro-dynamic shakers



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