The Centre for Power Transmission and Motion Control

UNIVERSITY OF BATH

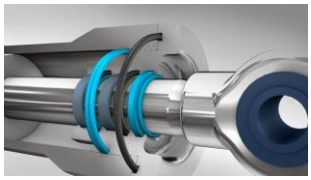
The Centre for PTMC: analytical and experimental research into next-generation machine systems.
Dr Nicola Bailey, Dr Jos Darling, Dr Jon du Bois, Dr Andy Hillis, Dr Nigel Johnston, Prof Patrick Keogh, Dr Roger Ngwompo, Dr Min Pan, Prof Andrew Plummer, Dr Al Hunter, Dr Pejman Iravani

PhD Project Vacancies 2017

Fully-funded studentships are available on a competitive basis. Studentships include all tuition fees for UK/EU citizens and a tax free maintenance allowance (stipend) of at least £14296 per year.

1. Rotorcraft research: smart rotor concepts and novel rotor configurations
A variety of rotorcraft research topics are open for investigation, from full scale manned aircraft to smaller, autonomous craft. Particular areas of interest are the development of cycloidal rotor systems, an unconventional arrangement of rotor blades with a horizontal axis of rotation, and the investigation of their potential advantages in terms of agility and efficiency; and smart rotor technologies for active vibration control. There is potential for large scale work with industrial partners such as AgustaWestland, or for smaller indoor work on agile swarms of autonomous micro-air-vehicles (MAVs). (Dr J L du Bois)

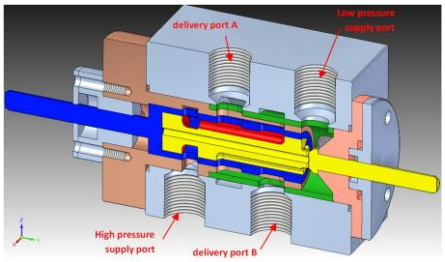
2. Novel Integrated Control of Fluid-borne Noise in Fluid Power Systems
The problem of high noise levels generated by hydraulically powered machines has risen in awareness amongst industry and the general public. Existing passive and active systems for fluid-borne noise attenuation have been applied in fluid power systems and shown to be effective to reduce noise. However, they are limited by their heavy weight, bulky size and cancellation bandwidth. This project will investigate a novel noise control system which integrates an active attenuator and passive tuned flexible hoses to obtain effective, robust and high-bandwidth noise attenuation for fluid power systems. (Dr M Pan).



3. Novel active seal design and control for high precision and high bandwidth motion control
In fluid power systems, seals are typically passive elements that limit the leakage of fluid. Friction forces are usually overcome by the hydraulic actuation capability. However, there are particular advantages to be gained by designing and integrating active seal elements into motion control systems. These include the precise control of the actuation force over sub-micron displacements together with high bandwidth control of the actuation force. It is envisaged that piezoelectric actuators will be integrated into active seal designs, which will also interface with material and tribological investigations. (Prof P S Keogh, Dr D N Johnston, Dr C R Bowen)

4. Hybrid Testing of Multibody Systems
Hybrid testing, also called model-in-the-loop testing or real-time dynamic substructuring, is a method for testing components of large or complex systems in a laboratory under realistic operating conditions. Part of the system is simulated numerically, in “real time”, while one or more components reside in the physical world. Actuators such as the robotic systems pictured are used to move the components in the real world and the control systems must be fast and accurate. Applications include car suspension and steering, aircraft undercarriages, air-to-air refuelling equipment, helicopter vibration control and earthquake protection for buildings. (Dr J L du Bois)

5. Additive Manufacturing for Next Generation Hydraulic Components
An advantage of additive manufacturing is the ability to form complex geometries that are impossible to make by conventional methods. The fabrication of novel geometries enables greater product optimisation for a particular function. There are also benefits in terms of the environmental impact of component manufacture and a reduction of lead-time for component production or redesign. This project will investigate novel approaches for the design of lightweight, high performance hydraulic components for aerospace and other applications. (Dr M Pan, Prof A R Plummer).



6. Modelling and Development of Low Noise Hydraulic Fluid Power Systems

Hydraulic fluid power systems are often very noisy, and the main cause of this is often pump flow ripple, which causes fluid-borne noise or pressure ripple. Techniques for reducing the flow ripple and pressure ripple will be investigated, including optimisation and tuning of the system and use of silencers and active noise cancellation. (Dr N Johnston)

7. High altitude, long endurance aircraft

Autonomous unmanned aircraft can fly indefinitely using solar panels for power. These aircraft must be lightweight with large wingspans to minimise the power required, and often need to fly at high altitude, thus increasing the need for large wing areas. The aircraft tend to be very flexible, like the NASA Helios aircraft pictured, and have complex aeroelastic behaviour. This project is concerned with the control of a high altitude, long endurance aircraft for autonomous operations. (Dr. J du Bois, Dr. P Iravani, Dr D Cleaver)

8. Intelligent powered prostheses

State-of-the-art prosthetic knees and ankles have microprocessor-controlled damping characteristics to provide relatively relaxed and natural level walking. However, amputees find activities such as stair climbing and fast walking more difficult. Fully powered prostheses have been investigated to tackle this, but these have short battery life, and can be unacceptably noisy. This project will investigate a hybrid concept, in which the prosthesis can operate passively during level walking or for a portion of the gait cycle, but can be powered at other times. This research will investigate and refine a prototype hybrid ankle developed at Bath in conjunction with Blatchfords. (Prof A R Plummer, Dr P Iravani)

9. Robotics

Various opportunities are available in the area of robotics. Including: (i) Development of soft polymer robots including touch sensitive skin materials for robots, (ii) Computer vision and control of autonomous quad bike, (iii) UAVs and systems such as radar, long range communications, novel mapping technologies. Other projects related to robotics and 3D printing are also available. (Dr P Iravani)

10. Industry 4.0: Digital Hydraulic System Control

In most hydraulically powered systems, the speed and/or force of a load are controlled using valves to throttle the flow and thus reduce the hydraulic pressure. This is a simple but extremely inefficient method as the excess energy is lost as heat, and it is common for more than 50% of the input power to be wasted in this way. Digital hydraulics, which means hydraulic systems having discrete valued components actively controlling system output, can potentially have higher efficiency and less energy loss. This project will investigate the fundamental of digital hydraulics and their feasibility via analytical modelling and experimental validation. (Dr M Pan, Prof A R Plummer).

11. Distributed actuation and control for active structures

The next generation of actuation systems, whether for aircraft control, robotic manipulation or other multi-axis applications, will be distributed through and closely integrated with the load-bearing structure. These smart morphing structures will provide better static and dynamic performance, redundancy and more versatility than current designs. This PhD research project will investigate concepts and control for fluid actuation of pinned pre-stressed frames or tensegrity structures (Prof A R Plummer).

For more information, please contact any PTMC academic, or Centre Director Prof Andrew Plummer (A.R.Plummer@bath.ac.uk, x6140, 8E2.2)

http://www.bath.ac.uk/ptmc/