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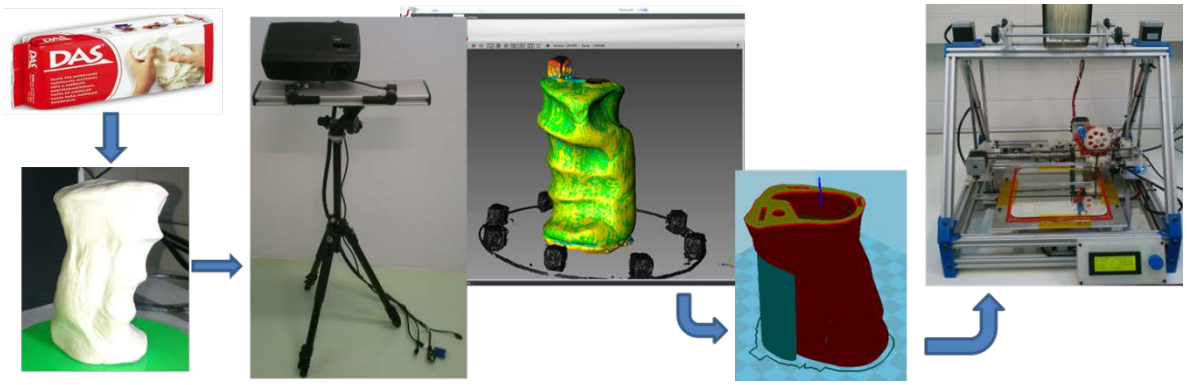
LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – DIN*per* research group.

The University of Burgos is delighted to welcome students from The Cooper Union. The positions are offered by several research groups working on different engineering fields as described in the following sections:

Technological aids for disabled people.

Introductory video.

PROJECT DESCRIPTION: This project comprises various offers in one. We are currently working on both mechanical and electronic design and manufacturing. The goal is always the development of technological aids for the disabled population. Our research line combines the design of wireless electronic devices, along with custom made mechanical actuators. Most users of our developments are children affected by severe mobility impairments.



Typical engineering process involves: modeling, scanning, 3D design and manufacturing.

What we obtain from this process is a custom made push button meant to emulate mouse click and so the customer can use the computer through specially design applications:

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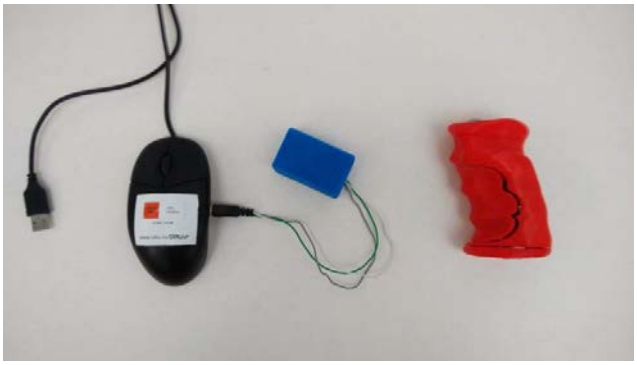
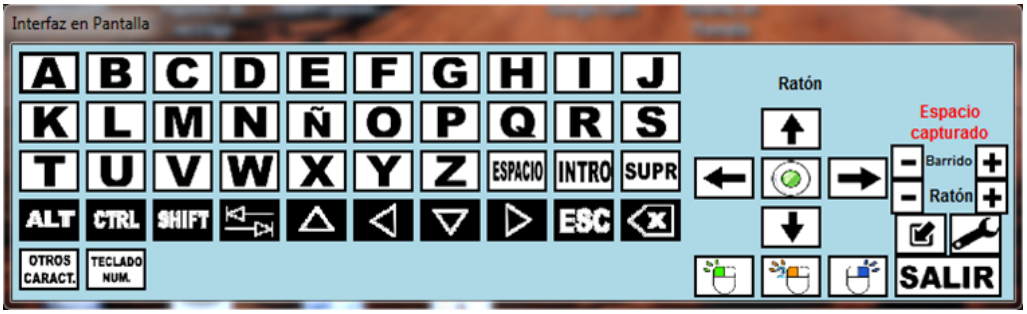


Wireless custom designed push button.



Scanning keyboard controlled by the above shown push button.

WHAT WE OFFER TO COOPER UNION STUDENTS:

1. Design and manufacturing of simple, low cost, low power electronic devices.
2. 3D design and manufacturing of custom made actuators. This involving 3D scanning and printing techniques.
3. Development of computer/mobile applications for disabled users.

STUDENTS PROFILES:

1. Electrical Engineering students (2 positions): electronic design and PCB manufacturing of small prototypes with wireless communication capabilities (Bluetooth, Xbee…). Remote sensor and actuator interfacing and control applications using microcontroller based solutions (Microchip PIC) or low cost end solutions (Arduino, RaspberryPi).
2. Mechanical Engineering, Interdisciplinary Engineering (2 positions): design and manufacturing of push buttons using 3D scanning and printing technologies.
3. Computer Engineering (1 position): development of small PC programs and Android apps meant to improve communication capabilities of disabled people.

COORDINATOR/CONTACT PERSON: Dr. José M. Cámara (checam@ubu.es).

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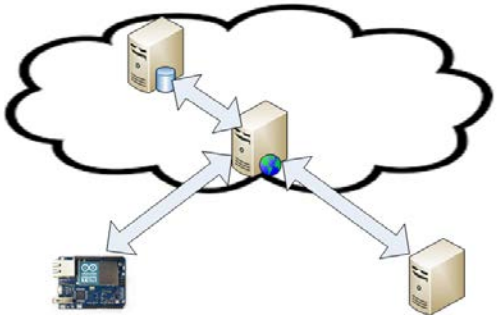
Internet of Things.

One of the key evolutions of technological devices in the last few years has been oriented towards connectivity. Connected with the previous offer, connected technological devices can make life easier to people affected by many types of disabilities. Our research group is on the search for certain applications making use of the latest developments of technology and even for innovative ways to connect devices to the internet.



The whole process involves:

- Hardware designing.
- Wireless devices programming
- Database configuration
- Remote access
- Remote control

WHAT WE OFFER TO COOPER UNION STUDENTS:

- Design and manufacturing of wireless devices.
- C++, php...
- Web site desig.

STUDENTS PROFILES:

- Electrical Engineering students (1 position).
- Computer Engineering (1 position.

COORDINATOR/CONTACT PERSON: Dr. José M. Cámara (checam@ubu.es).

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LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY - Research Group on Energy Engineering MMT-1

Internship 1

Research Line:

Research on thermodynamic properties at high pressure and high temperature of new bio-fuels obtained from renewable sources.

Coordinator / contact person:

Dr. Eduardo Montero García (emontero@ubu.es).

Description:

Over the last decades the reduction of emissions during production, transportation, storage and, of course, the use of industrial fluids in engines and energy industry has become a very important worldwide objective. Considerable effort is being spent on the development of low carbon technologies, with the aim of reducing emissions. Energy industrial fluids like bio-fuels, CO_2-fluid mixtures, refrigerants, heat transport liquids, phase change materials for energy storage or lubricants present frequently a complex mixture of a large number of components that have to meet international standards and quality criteria.

Many new compounds have to been produced and developed to reduce pollutants from transportation and energy industry exhaust gases and effluents. Proponents of these new low carbon fluids claim several advantages: they improve physic and chemical properties, they can be produced from renewable agricultural and raw materials instead of fossil sources, and they reduce greenhouse gas emissions.

This project concerns with the accurate measurement, correlation and prediction of thermodynamic and transport ptoperties properties of in new low carbon energy fluids, (including but not limited to bio-fuels, CO_2-fluid mixtures, refrigerants, heat transfer fluids, lubricants, phase change materials for energy storage, etc.) such as density, viscosity, thermal conductivity, isobaric heat capacity, vapor-liquid equilibrium behaviour, water inmiscibility range, distillation curve, mixing enthalpy and heating values, at different pressure and temperature conditions.

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Priority Area:

Renewable energy, sustainability

Student profile:

Mechanical Engineering, Chemical Engineering, B.Sc. Physics, B.Sc. Chemistry

Recent references

M. Dakkach, F. Aguilar, F. E. M. Alaoui, E. A. Montero, Liquid density of oxygenated additives to biofuels: 2-Butanol at pressures up to 140 MPa and temperatures from (293.15 to 393.27) K, Journal of Chemical Thermodynamics 2015, 89, 278-285.

F. E. M. Alaoui, F. Aguilar, M. J. González-Fernández, M. Dakkach, E. A. Montero, Excess enthalpies of ternary mixtures of (oxygenated additives + aromatic hydrocarbon) mixtures in fuels and bio-fuels: (Dibutyl-ether + 1-propanol + benzene), or toluene, at T = (298.15 and 313.15) K, Journal of Chemical Thermodynamics 2015, 85, 26-34.

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Margarita Ortega, Pablo del Río, Eduardo A. Montero, "Assessing the benefits and costs of renewable electricity. The Spanish case", Renewable and Sustainable Energy Reviews, 2013, 27, 294-304.

Fatima E.M. Alaoui, Eduardo A. Montero, Guosheng Qiu, Fernando Aguilar, Jiangtao Wu, "Liquid density of biofuel mixtures: 1-Heptanol + heptane system at pressures up to 140 MPa and temperatures from 298.15 K to 393.15 K", J. of Chemical Thermodynamics, 2013, 65, 174-183.

F. Aguilar, F.E.M. Alaoui, J.J. Segovia, E.A. Montero, "Excess enthalpies of ternary mixtures of oxygenated additives + hydrocarbon mixtures in fuels and bio-fuels: Dibutyl ether (DBE) and 1-butanol and 1-hexene or cyclohexane or 2,2,4 trimethylpentane at 298.15 K and 313.15 K", J. Chemical Thermodynamics, 2013, 56, 6-11.

J. M. García-Alonso, F. Aguilar, E. Montero, "Energy simulation and feasibility of a Ground-Source Heat Pump coupled with a Phase Change Material energy storage system for heat supply", Renewable Energy & Power Quality Journal, 2013, 11, paper 358.

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LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – Structural Integrity research group.

Position 1: Fatigue and fracture of materials, components and structures.

STUDENTS PROFILES: Mechanical Engineering / Civil Engineering.

COORDINATOR/CONTACT PERSON: Professor D. Jesús Manuel Alegre (jalegre@ubu.es).

Brief description:

The Structural Integrity research group of the University of Burgos is in one of the most relevant research group in Europe, related to the testing and numerical simulation of fatigue and fracture of metallic materials. In this research you will learn about fracture and fatigue testing methods, numerical simulation of fatigue and fracture of metallic materials and its application to the design of components and structures. Also you have the opportunity to initiate in some experimental techniques to measure residual stresses in components, such as the *hole drilling* method, and to know the effect of residual stresses in the fatigue behavior of metallic materials.

Position 2: Structural integrity of components subjected to high temperature (creep and creep-fracture).

STUDENTS PROFILES: Mechanical Engineering / Civil Engineering.

COORDINATOR/CONTACT PERSON: Professor D. Jesús Manuel Alegre (jalegre@ubu.es).

Brief description:

In order to assess the reliability of components continually exposed to high temperatures, such as those working in power generation plants, accurate methods to predict the time for Creep Crack Initiation (CCI) and the rate of the Creep Crack Growth (CCG) are required. In this sense, creep crack initiation and early growth constitute the most important part of the life under creep conditions. According to ASTM E-1457 Standard Test Method for measurement of Creep in metals, the recommended specimen is the standard compact tension specimen C(T) and pin loaded in tension under constant loading conditions. In this research, we investigate the use of alternative miniature specimens, such as Small Punch Creep Tests, as an alternative creep crack initiation testing practice applicable in those cases where there is not enough material for the realization of conventional tests, such as the C(T) reference test.

This could be a nice opportunity to work in one of the most relevant research group in Europe, related to the testing and simulations of metallic materials subjected to high temperatures.

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LIST OF PROJECTS OFFERED TO INCOMING STUDENTS FROM THE COOPER UNION UNIVERSITY – Sustainable Construction Research Group SUCONS

The positions are offered by several working groups specialized on different engineering fields as described in the following sections:

TITLE: Maximizing the sustainable value of materials and products in the construction sector, incorporating by-products from steelworks

ACRONYM OF THE PROJECT: BlueCons II and BU119P17

Introductory video: https://youtu.be/xPaoZ--YF-I

PROJECT DESCRIPTION:

From the science of material (knowledge) to the concept of final product (construction market), this project would climb the study of the incorporation of some industrial by-products of manufacturing steel in certain materials and building products. As a key sector of our country, the manufacture of electric steel industry, massively, generates two types of by- products: EAFS - black oxidizing slag and LFS - white reducing slag from steelworks. On the other hand, the construction industry is a major consumer of raw materials. Therefore, strengthening in the knowledge applied already existing on the subject, in addition to opening new fields of use, this project raises the reuse of the EAFS and LFS in applications for building and civil engineering, as a component of value added in inorganic matrices (cement pastes, mortar and concrete), organic (mixtures with asphaltic bitumen) and mixed (improvement of soils). All this by maximizing the sustainable value of the solutions adopted according to a triple perspective: functional, energetic and economic (market viability); for which in order to analyse the sustainable value of the solutions adopted, against other more conventional. Ultimately, with BlueCons, it is tried to steer this new ways, which have been called the blue economy, towards the construction sector.

The relevance of this coordinated project is referred to the construction market in aspects such: "formula of work" (mortar/concrete/asphalt plants), "additions" (cement) and "types of soil" (paver).

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PROJECT (UBU): CIVIL CONSTRUCTION

Internship 1: HEAF IN PAVEMENT ROADS AND RADIOLOGICAL SHIELD (ONE STUDENT FROM COOPER UNION)

COORDINATOR/CONTACT PERSON:

PhD. Juan M. Manso (jmmanso@ubu.es) and
PhD. Vanesa Ortega (vortega@ubu.es)

Contents: Development of concrete formulations made with EAF slag (EAFC) applied to pavements: ground floors (industrial infrastructure) and wearing courses (roads). Laboratory formulations for basic characterization will be addressed according to applicable regulations and trying to meet the requirements of the industrial pavements and road wearing courses.

The use of EAFC is also studied as a shield against radiation for infrastructures and buildings for the nuclear sector (X-rays and gamma rays). Analyses will be performed on a small scale in the laboratory, using as a reference a regular concrete. Rules and conventional procedures will be used.

Internship 2: STUDY OF BITUMINOUS MIXTURES CON EAFS y LFS (ONE STUDENT FROM COOPER UNION)

COORDINATOR/CONTACT PERSON:

PhD. Juan M. Manso (jmmanso@ubu.es) and
PhD. Marta Skaf (mskaf@ubu.es)

Contents: Manufacture of bituminous mixtures with EAFS as coarse aggregate and LFS as filler, analyzing their behavior as draining base and wearing course for roads. Abrasion and tire adhesion will be tested, as much as its mechanical behavior with heavy traffic in its key issues: flexibility, dissipation ability and fatigue resistance.

WHAT WE OFFER:

Collaborative working in laboratory testing of large structures and construction materials.

STUDENTS PROFILES:

One or Two Students of Civil Engineering

REFERENCES

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[4] Manso JM, Hernández D, Losáñez MM, González JJ. Design and elaboration of concrete mixtures using steelmaking slags. AMERICAN CONCRETE INSTITUTE Materials Journal. 2011;108(6):673-81.USA.

[5] Manso JM, Polanco JA, Losanez Gonzalez M, Gonzalez JJ. Ladle furnace slag in construction. AMERICAN SOCIETY OF CIVIL ENGINEERS. Journal of Materials in Civil Engineering 2005;17:513–8.USA

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