

## EUROShoE: a custom-made high-range shoe

**EUROShoE is a research project within the EU-funded Fifth Framework Programme. It aims to overhaul the footwear industry by introducing a mass-produced 'customised' shoe. The project brings together 34 European partners, including iCIMSI, an Institute of the Department of Innovative Technologies (DTI), University of Applied Sciences of Southern Switzerland (SUPSI). The study has concentrated on the production process for custom-made soles made of polymer materials and on the invention of a variable-geometry mould to produce customised footbeds.**

In recent years, the European footwear industry has been increasingly confronted with fierce competition from the Middle- and Far-East markets, where labour conditions and costs are notoriously cheaper. While low-end shoes have been produced outside Europe for quite some time now, middle-range shoe production seems to be following suit. EUROShoE was conceived to fight this trend. As a research project of the Fifth Framework Programme subsidised by the European Union, it brings together 34 European members, including the CIM Institute (iCIMSI), affiliated to the Department of Innovative Technologies (DTI) at the University of Applied Sciences of Southern Switzerland (SUPSI). EUROShoE fosters collaboration between national and European institutions, research centres, and universities, but equally with the industries; in this sense it is a very typical example of technological transfer.

Underpinning the project is the ambition to revamp the footwear sector through market innovation. Consumers would be offered, with no price hike, high-tech customised shoes answering their expectations (size, comfort, style or colour). "EUROShoE wants to turn the concept of shoe on its head, by advocating a new conception of the product", explains Walter Amaro, an engineer in charge of this study

### The CIM Institute of Southern Switzerland (iCIMSI)

Founded in 1992 under the name of CIM Centre of Southern Switzerland, in January 1998 this name turned into iCIMSI or Institute for Applied Computer Sciences and Industrial Technologies of the University of Applied Sciences of Southern Switzerland (SUPSI). iCIMSI's staff is made up of researchers and engineers with long years of experience in the transfer and implementation of innovative technologies in industries. The Institute is an integral part of a network of national and international centres of excellence designed to support small- and medium-sized enterprises. iCIMSI's projects cover research and rapid development of new products, their production on an industrial scale, the (re)design of its production processes, the automation and integration of its manufacturing techniques, the integration and management of its logistical chain, the development and integration of a customer-suppliers network and the introduction of a collaborative inter-firm network for small and medium-sized enterprises.



The iCIMSI research team (left to right): Dr Ermanno Oberrauch, Luca Diviani (engineer), Walter Amaro (engineer, head of the project) and Marco Colla (engineer).

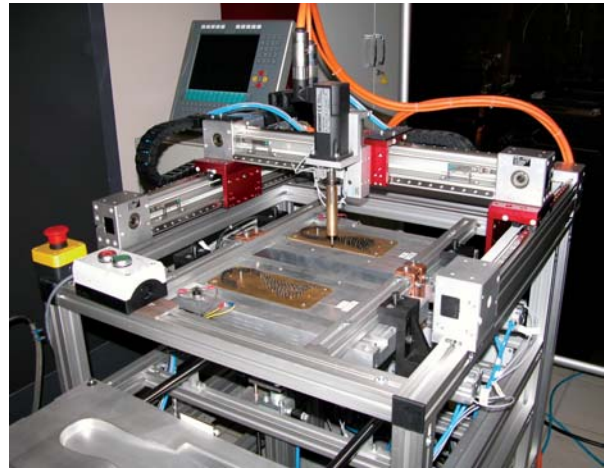
at iCIMSI. "What we need to do is switch from mass-produced goods, to custom-made mass-produced goods. In other words, we would like to see customised shoes manufactured on an industrial scale, while assuring that the quality of the end-product compares favourably with its handicraft counterpart. To do this, we must review the entire life-cycle of shoe manufacturing: from design, to production, to distribution and sale, to use and maintenance, down to disposal and recycling".

In the not too distant future, customers in a shoe shop will be able to point to a model they like best and order a pair made up to measure. A sophisticated scanner, in fact, takes a 'reading' of the footprint, processes it into a digital casting, and subsequently re-assembles it into a 3-D picture of the foot that takes into account also the individual's posture. These data, added to the customer's aesthetic preferences, will go to make up a pair of shoes that best fits the customer's demands.

iCIMSI has played an important role in the EUROShoE research by conducting a survey of the Swiss partner, Bally Caslano, and making its expertise available in the fields of polymers, industrial automation, and programming, as well as in terms of technique and statistics.

## Consumer- rather than production-oriented

Under the EUROShoE banner, iCIMS I has advanced on two research lines: one is a study of the mechanisms at work in the production of custom-made plastic soles, allowing for material shrinkage; the second is the construction of a variable-geometry mould for the production of custom-made footbeds to be fitted inside the shoe. In conducting the former study, the main point was to obtain individual-fit polymer soles without having to resort to a whole variety of moulds. Now, contrary to what happens with leather soles (for which no complex operation is required to produce various sizes and fits, since leather can be cut by a water jet, by a laser beam or by punching through), polymer-material soles demand a casting process. Consequently, in order to manufacture made-to-measure soles, one needs to build an appropriate mould not only for each size (e.g. one for size 6, another for size 7, etc.), but also for fractions of size numbers, hence the soaring costs of machinery. If we want to be able to use the same mould for the fractions of a number, the basic constraint is to find a method allowing us to vary (increase or decrease) the shrinkage of the plastic material and, at the same time, to keep it in check or regulate it. *"iCIMS I's work addressed the problem of finding the most suitable blends or mixtures and the process parameters with which to measure out a polymer injection adjusted so as to keep material shrinkage in check"*, explains Amaro. Interestingly, iCIMS I's researchers came up with the following test results: one can master shrinkage by up to 6%, which is a significant step forward in assessing the feasibility of further development methods. As to the second line of research, iCIMS I has turned its attention to the creation of a variable-geometry mould on which to cut footbeds, to be fitted into the inside of the shoe, the upper part is then customised, not only according to the foot's



The variable-geometry mould constructed by iCIMS I for the manufacturing of custom-made footbeds.

length but also to its shape. iCIMS I has benefited from the expertise of the Institute of Bio-mechanics, Valencia (IBV), which carried out a survey of different shapes of footbeds, in Spain, and thus supplied to iCIMS I figures relating to a foot's comfort zones and their geometrical variation (maximum and minimum). On this basis, iCIMS I has built a machine, the variable-geometry mould. The upper part of the machine, which replicates the side of the footbed in contact with the foot, can be adjusted, by means of the so-called 'actuators', which are components in the shape of little studs moved, or regulated, up or down to simulate the shape of the foot. *"It is early days, yet; it's a pilot model, but one which can be used in future in the manufacturing of customised footbeds"*, remarks Amaro in his conclusion. At the moment, one can order a pair of shoes to be made to measure, by contacting the Laboratory of the Institute of Industrial Technologies and Automation (ITIA), of the Italian National Research Council (CNR), Vigevano, where a pilot plant is already operational.

### Project's sponsors and partners

EUROShoE is a project of the Fifth Framework Programme of European Union, which involves 34 partners from all over Europe: 7 shoe-making firms, 11 research and academic institutions and 16 suppliers of machinery, software, and CAD design systems. Major partners in this project include; the Institute of Industrial Technologies and Automation (ITIA) of the National Research Council (CNR), Italy's state agency overseeing research. In Switzerland, in addition to iCIMS I (affiliated to the Department of Innovative Technologies at SUPSI) another member of the project is the footwear company, Bally, located in Caslano.

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