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Sommario	Thermo-physiological comfort is a complex feeling affected by clothing, environment and physical activity of a human body. It is very important to understand the influence of the different variables, such as air temperature and humidity, fabric properties and heat and moisture produced from the human body, and their relationships in order to design new textile materials that can satisfy the always more strictly requirements of technical textile in terms of comfort behaviour. While environmental conditions and metabolic heat and moisture production are independent variables that should be analyzed but that cannot be modified because they depends from the physical activity and from the environment where it should be done, garments behaviour can be modified, using different materials, construction parameters, etc..., in order to give the optimal comfort behaviour. In the last decades, always more attention has been paid in the development of comfortable clothing for both technical and common use; for this reason the interaction of garments with both the human body and the environment has been the subject of many studies. This research work aims to analyze the comfort properties that can be measured for fabrics evaluation and to develop, using modelling techniques, a prediction method of comfort behaviour; four fabric properties, namely air permeability, thermal properties, liquid and vapour transport through the fabric has been analyzed. A fabric is a heterogeneous 3D ordered structure made of fibres, yarns

	and trapped air and for this reason in order to be able to predict its comfort properties it is necessary to predict its geometrical structure using only its basic design parameters; this is the first stage for the development of any prediction method because comfort properties highly depends from fabric structure. In this work, starting from the basic design parameters of yarns and fabrics and using the geometrical fabric model developed by Hearle, all the fabrics geometrical parameters have been defined; later, using TexGen, an open source software developed at the University of Nottingham in 1998, the fabric geometries have been created. The second stage of this research work has been focused on the simulation of the fabrics comfort properties, for different fabrics structures and composition, and their comparison with experimental values. Air permeability, that represent the resistance to the air that flows through the fabric, is one of the most important parameters that influence comfort properties, because it influences both the vapour and moisture transport and thermal properties. Simulations that have been done show that it is possible to predict, with a good approximation, air permeability behaviour of different fabrics. Thermal properties, namely thermal resistance, have been investigated using a simplified geometry of textile fabrics in order to better compare the 3D virtual model with the experimental tests; in this case there is a quite good approximation of the simulated values due to this simplified geometry. For thermal properties modelling not only the comparison with experimental tests has been done but also some simulations that better represents a real case, in which fabric is not pressed between the measuring heads but where its distance from the skin can vary from contact to some millimetres. Also vapour adsorption process have been investigated in order to analyze the behaviour of different fibres and for different temperature and relative humidity conditions. When the human body is under low physical activities the air layer between skin and fabric can reach temperature in the range of 30°C to 40°C and relative humidity in the range of 60% to 90%; in these cases the prediction of the adsorption mechanism, that is an exothemic process, has to be taken into account especially for natural fibres that have high values of differential heat of sorption. Finally a case-study, represented by a 3D model of a back protector, is presented; using the experimental data measured in the climatic chamber at the Advanced Technology Textile Laboratory in Biella, some thermal simulations has been carried out. The research aims to develop a simulation method that starting from the basically constructive parameters of fibres, yarns and fabrics used to create any 3D fabric geometries leads to a fully predictive simulation method that allow to reduce the costs for the development of new high performance fabrics
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