Final Year Project Showcase Batch 2019
Year 2023

	Department: Textile Engineering Programme: Textile Engineering
1	**Project Idea** Parametric computational analysis of plain weft knitted fabric for the study of air permeability and thermal conductivity.
2	**Process** Simulation and modelling
3	**Outcome** The air permeability and thermal conductivity of plain weft knitted fabrics by using computational analysis were predicted. Comparisons were made between the experimental results and the simulated outcomes which were found to be highly correlated. Parametric analysis was also done to predict and analyze the relationship between the structural parameters and air permeability as well as the thermal conductivity of fabrics. All the results of the parametric analysis were proved theoretically.
4	**Evidence (Theoretical Basis)** The thermal comfort of the wearers is significantly impacted by the fabric's thermal characteristics. The degree to which materials effectively transfer body heat and moisture to the outside environment is thermal comfort. In this project, the air permeability and thermal conductivity of plain weft-knitted fabrics were evaluated. These two properties hold significant importance where the comfort ability of fabrics is concerned. There are two methods to evaluate these properties, one is computational analysis and the other is experimental testing. The methods of modelling and simulation are more convenient than using experimental devices because they have fewer limitations and the virtual world provides room for many possibilities. Computational analysis is more cost-effective than using experimental devices because it eliminates destructive testing of materials. In this project, we have utilized the method of computational analysis to obtain the required data. We have used Computational Fluid Dynamics (CFD) for the evaluation of air permeability and Finite Element Analysis (FEA) for the evaluation of thermal conductivity. The geometrical models of different samples of fabric having different types of synthetic fibers like acrylic, polyester, and polypropylene, which consisted of different types of yarns (i.e. multi-filament, monofilament, and staple) were built using COMSOL Multiphysics and the models were constructed using the actual parameters of the samples. The results of both air permeability and thermal conductivity were compared with the experimental results to validate the models and it was found that the values were highly correlated. Furthermore, the validated models are used for the parametric analysis which is done by varying the parameters of the samples. The relation of course per cm, wale per cm, thickness, and stitch density (at constant course per cm and wale per cm) with air permeability and thermal conductivity were analyzed and the results give the same relation as theoretically proved.
5	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** The comfort and livability of urban settings, both indoors and out, depend heavily on the thermal qualities of materials. The quality of life in cities is a key component of SDG-11 and is directly impacted by the materials used in urban contexts, such as clothes, furniture, and outdoor shelters.
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the

	following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence	
a	**Attainment of any SDG** Air permeability and thermal conductivity is an important factor for textile and clothing as it greatly impacts the comfort level. This is because the human body releases heat during hot and extreme environmental conditions so, the heat must be exchanged between the body and clothing for breathability by this **SDG#03: Good Health and Well-being** was attained.	
b	**Cost Reduction of Existing Product** In this research computational analysis was used, which is the best approach for investigating air permeability and thermal conductivity because experimental testing is destructive and it is being used throughout the world. It is a cost-effective process as well as a time-saving process.	
c	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** Moving from experimental testing to computational method which is highly cost effective.	
d	**Expanding of Market share** Market share wouldn't be a primary metric for this project, but rather its impact on improving fabric properties and potentially influencing the textile industry.	
7	**Target Market** • Textile Industry Professionals: Those people who work in the design, development, and manufacturing of textiles who are trying to enhance the performance and characteristics of their fabric. • Research Institutions and Academia: Professors, researchers, and students in textile engineering, material science, and related fields looking for advanced simulation tools and insights. • Fashion Industry: Designers interested in understanding how different fabrics behave in terms of thermal properties and air permeability for innovative clothing designs. • Quality Control and Testing Laboratories: Facilities responsible for assessing fabric quality and properties for compliance with industry standards. • Apparel Manufacturers: Companies producing sportswear, outdoor clothing, or specialized garments where thermal and air permeability properties are critical for performance.	
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