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NUMERICAL MODEL DEVELOPMENT FOR THE OPTIMIZATION OF WOOD COATING ENCLOSURES

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Abstract: *Current tendencies around sustainability linked to building façades encouraged us to develop a new system which, apart from presenting a low environmental impact with relation to both production and waste of material, also allows a continuous savings of energy during the whole building life cycle. In this regard, wood is characterized for being a renewable and ecological resource whose production helps to mitigate the CO released to the atmosphere, cutting down the carbon footprint.*
In this project, different façade solutions will be carefully analyzed, in terms of energy savings, whose exterior layer is made up of a group of identical joined wood strips. Different shapes and configurations will be addressed, taking into account also the global aesthetics of the solution finally adopted. For this purpose, a case study will be carried out by simulating different cross-sectional areas through the THERM v 7.3© software, to obtain the thermal behavior of the material through the estimation of its thermal resistance as a whole.
From these results, a numerical model based in the geometry and thermal properties of timber walls according to the current Spanish regulation will be built. The relationships of the different parameters involved such as, geometries, endurance treatments, etc. will allow us to establish a complete methodology for estimating the thermal resistance of different solutions, in order to obtain a fully optimized wooden enclosure. The wood selected is the so called "Pinus Radiata", *valued for rapid growth and desirable lumber and pulp qualities is a common specimen in the Basque Country.*

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function is wrongly considered to be only the climate protection. On the other hand, the shorter the wood strips, the higher the thermal resistance offered.

The simplified numerical model is close to the real scenario as has been shown here, being the error values lower than 4 %. This method allows a relatively easy estimation of the thermal resistance of particular solutions without the higher requirements of finite elements software. Besides, it makes easier the comparison between different configurations, as the calculations are simplified, so both material optimization and energy efficiency are possible. In fact, they are nowadays some of the most relevant issues in terms of sustainability which is the main objective of this research, trying to reduce the carbon footprint generated by other traditional fossil fuels consumption and preserve our environment.

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NOMENCLATURE

Ac:	Square Area [m^2]
At:	Triangle Area [m^2]
As:	Curved Area [m^2]
C:	Correction factor related to the compactness (= P1/P2)
CLT:	Cross Laminated Timber
e:	Thickness [m]
e1	Total thickness [m]
e2:	Constant thickness [m]
er:	Equivalent thickness [m]
EEN:	Energy Error Norm [%]
EPS:	Expanded Polystyrene
ETICS:	External Thermal Insulation Composite Systems
h:	Length [m]
h1:	Constant length 1 [m]
h2:	Discontinuous length 2 [m]
h3:	Discontinuous length 3 [m]
hc	Convective coefficient [W/m^2 K]
OSB:	Oriented Strand Board
PE:	Polyethylene
P1:	Relative perimeter [m]
P2:	Global perimeter [m]
R:	Total thermal resistance [$m^2 \cdot K/W$]
R1:	Global resistance (= $e1/\lambda$) [m^2 K /W]