

From Utilizing Material to Listening to What "Material Speaks"

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Abstract

For the 60th anniversary of IASS, I would like to introduce a designing method for innovative ideas, which I developed through structural designing in last 50 years. I named the method as Material Speaks Design. While conventional methods have designed frameworks in space by focusing on characteristics particular to each material [mechanical characteristics] to utilize them, Material Speaks Design, focusing on energy [J:joule] particular to each material used, enables to compare frameworks in space with different originality, variety, and regionality beyond time and place. To understand the former, I use following function.

Epistemological Structural Design of Material and Space Function :

$$E_{SD} = f(M_x, S_y, L_z, J_n, C_\alpha, D_\beta, E_\gamma) \geq (\text{natural condition, social environments, client's demand, design to date}) \dots\dots\dots(a)$$

E_{SD} : epistemological structural design of material and space M_x : material, S_y : skeleton, L_z : load, J_n : joint, C_α : cost, D_β : durability, E_γ : erection

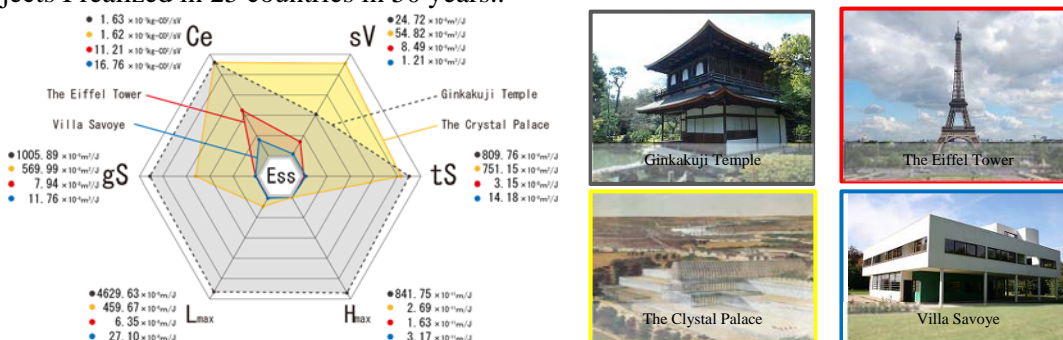
For the latter, Material Speaks Design, below is the function I use.

Structural Energy of Material and Space Function :

$$E_{SS} = \sum_{n=1}^n mEn \text{ [kNm/J]} \times mVn \text{ [m}^3\text{]} \dots\dots\dots(b)$$

E_{SS} : structural energy of material and space [kNm=J] E : Young's modulus of material [kN/m²], m : material, V : quantity of used material (volume) [m³], n : number of kinds of used material

This Structural Energy of Material and Space Function makes possible to compare efficiency of framework in space, and moreover, CO2 emission efficiency until completion of the building beyond material, space, time and place. This means we can compare The Eiffel Tower made of cast-iron and wrought iron, burnt down The Crystal Palace of cast-iron, wrought iron, glass and wood, Villa Savoye of concrete, and "Silver Pavilion" Ginkakuji Temple of wood, located in different parts of the world. Another example, when planing Villa Savoye, originally built in suburban Paris with few earthquakes, in a country with frequent earthquakes, reaction of framework in space and material efficiency can be compared. This new function depend on $E=mc^2$. This method is based on the 2,500 projects I realized in 25 countries in 50 years..



References

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