Emboss Tower

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Emboss tower explores the function of a structural skin with an embossed surface applicable to use for tall building structures. The major diagrid system with a secondary embossed surface structure provides an enhanced perimeter structural system by increasing tube section areas and reduces wind loads by disorienting major organizing wind forces.

A parametric study used to investigate an optimized configuration of the embossed structure revealed that the embossed structure has a structural advantage in stiffening the structure, reducing lateral drift to 90% compared to a non-embossed diagrid baseline model, and results of wind load analysis using computational fluid dynamic software, demonstrated the proposed embossed system reduced lateral surface loads.

The resulting undulating embossed skin geometry presents both opportunities for incorporating versatile interior environments as well as unique challenges for daylighting and thermal control of the envelope. Solar and thermal control requires multiple daylighting solutions to address each local façade surface condition in order to reduce energy loads and meet occupant comfort standards.

These findings illustrate that although more complex in geometry, architects and engineers can produce tall buildings that have less impact on our environment by utilizing structural forms that reduce structural steel needed for stiffening, thus reducing embodied CO2, while positively affecting indoor quality and energy performance, all possible while creating a unique urban iconography derived from the performance of building skin.

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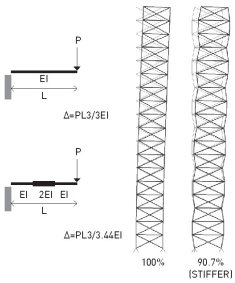
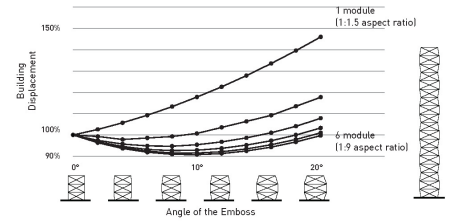
EMBOSS TOWER

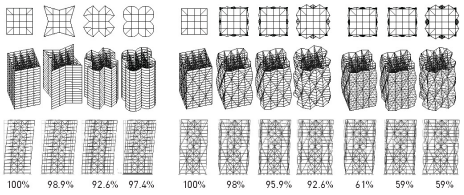


The Emboss tower explores the function of structural skin, by shaping the surface of embossing to enhance the stiffness of tower. The skin also disorients major organizing wind reducing significant surface wind pressure to reduce steel tonnage for the structure. The self-shading effect allows for interior shading systems to be specified for each sub-surfaces inclination and azimuth angles, permitting more location specific solar control. The planning behind the embossed skin also allows versatile office environments and presents a unique urban iconography to the street derived from performance of the building skin.

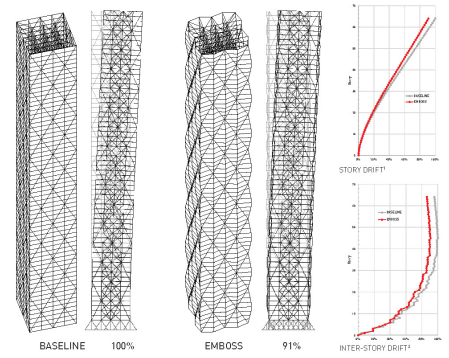
BUILDING DRIFT IMPROVEMENT BASED ON THE PRINCIPLE OF DEFLECTION OF BEAMS



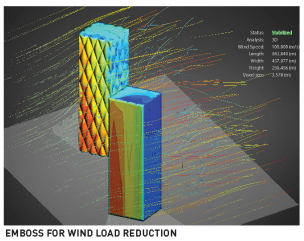
OPTIMIZED DEGREE OF THE EMBOSS MODULE



SURFACE SHAPE AND STRUCTURAL STIFFNESS

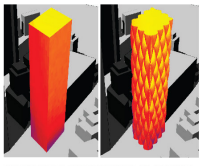


INCREASED EFFICIENCY OF STACKED EMBOSSED MODULE



CFD computational analysis shows that the embossed skin could significantly reduce the base shear force of the structure. For example, the base shear forces of the embossed skin type under 90° and 120° angles of attack are, respectively, 18.06% and 21.20% less than those of baseline model.

EMBOSS FOR WIND LOAD REDUCTION



The embossed form would benefit greatly from local solutions for controlling the local indoor environment, external shading, and glare than a uniform approach derived from each elevations general orientation as would be typical of a linear building envelope.

EMBOSS FOR EFFICIENT SOLAR CONTROL