A design method for fixed outside solar shading device

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Disposition

• **Motivation:** the background for the fixed outside solar shading device

• **The design method**
  – Window design
  – Sky sector for undesired solar radiation
  – Initial design of a shading panel
  – Obstruction of the diffuse light
  – Correction of the initial design

• **WONDERWALL project**
Motivation

Climate conditions

- Low mean solar altitude angle,
- Sunlight:
  - low luminous intensity
  - low colour temperature
- The sky is overcast in nearly half part of the day hours during a year.
- In windy regions the changes in cloud cover are very fast the shading control systems fail to handle them properly.

Users

- People love to experience solar heat on the body
- They admire sun patterns, both inside and outside
- Indoor curtains against glare
The design method

- Window design
  \[ DF > DF_{\text{min}} \]

- HSS sky sector for undesired solar radiation
  \[ 15 < \alpha < 45, \quad \alpha_{\text{mean}} = 30^\circ \]
  \[ 15 < \beta < 47, \quad \beta_{\text{mean}} = 31^\circ \]
The design method

Initial design of a shading panel

Vertical section, $\alpha=30^\circ$

Horizontal section, $\beta=31^\circ$

$15 < \alpha < 45$, $\alpha_{\text{mean}} = 30^\circ$

$15 < \beta < 47$, $\beta_{\text{mean}} = 31^\circ$
The design method

Initial design of a shading panel

Horizontal section, $\alpha_{\text{mean}} = 30^\circ$
$15^\circ < \alpha < 45^\circ$

Vertical section, $\beta_{\text{mean}} = 31^\circ$
$15^\circ < \beta < 47^\circ$
The design method

Obstruction of the diffuse light

The luminance distribution of the standard CIE overcast sky as the percentage of zenith luminance for 10º sky sectors

Angle dependent light transmittance 2 glass panes, 10º sectors,

SF contribution through a two pains of glass from the 10º x 10º sky unit sectors
The design method
Obstruction of the diffuse light

SF sky-unit diagram
SF contribution through a two pains of glass from the 10° x 10° sky unit sectors

<table>
<thead>
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<th>VERT. shad. angle</th>
<th>HORIZONTAL shading angle</th>
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<tr>
<td>80-90</td>
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</table>
The design method
Correction of the initial design

obstruction mask at the SF sky-unit diagram

SF reduces from the maximum value of 26.0% to about 23.7%

SF reduction 9%

15° < α < 45°
15° < β < 47°
The WONDERWALL project

Awarded with a purchase in the international architectural competition “The most energy efficient building in Europe” in Bjørvika, Oslo, 2005.
Axonometric perspective of the shading panels in the lower part of the east façade.
The WONDERWALL project

Vertical section
WONDERWALL

Facade west: with and without sunlight

Upper window

Lower window