RADIATION IN THERMAL COMFORT SIMULATIONS

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Thermal comfort

- Radiant temperature
- Insulation of clothing
- Activity level
- Relative humidity
- Air temperature
- Relative air velocity
Thermal comfort

- Radiant temperature
- Relative humidity
- Activity level
- Insulation of clothing
- Air temperature

Global thermal comfort:
- Mean radiant temperature

Local thermal discomfort:
- Radiant asymmetry
Overview

Projected area factor

Projected Area Factor
Projected Area Factor

- Taylor 1956
- Underwood and Ward 1966
- Fanger 1970
- Rizzo et al 1992

How are they compared?
Cylinder

Projected Area Factor, Cylinder-algorithm + Fanger

Azimute angle, $\alpha$

Cylinder, optimized to Fanger

Projected Area Factor, Cylinder-algorithm + Fanger
Comparison of algorithms

Oval cylinder, optimized to Fanger
Comparison of algorithms

Projected Area Factor, algorithm by Rizzo et. al. + Fanger

Azimute angle, $\alpha$

Projected Area Factor, Cylinder-algorithm + Fanger

Projected Area Factor, algorithm by Underwood and Ward + Fanger

Comparison of algorithms

Run Time pr 1000 calc.

Rizzo
Underwood
Cylinder
Overview

Projected area factor

View factor

View Factor
Comparison of View Factor

Fanger

\[ f(\theta, \phi) = F_{\text{amb}} \cdot \exp(-\frac{\theta}{\theta_0}) \]

Cannistraro

Comparison of View Factor

Fanger

Sphere

Rizzo

\[ f(\theta, \phi) = F_{\text{amb}} \cdot \exp(-\frac{\theta}{\theta_0}) \]

Ray tracing
Calculated View Factors

Effect on mean radiant temperature

18.30°C
18.79°C
18.25°C
18.22°C
Summary

- Compared to Fanger’s measurements, the best projected area factors are calculated with the most complex model.
- The calculation time for projected area factor is very short.
- The view factors calculated with a sphere, were different from the other.
- Which of the that is best is hard to tell.

What is next?

- Contact Italiens to make a better algorithm for projected area factor.
- View factor calculations for complex rooms.
- Find out the postures influence of projected area factor and view factor.
Overview

Projected area factor

View factor

Radiation from other persons

Radiation from other persons
Radiation from other persons