View Factor between Rectangles: Parallel or Perpendicular

Radiation view factor between two aligned parallel rectangles or two perpendicular rectangles sharing an edge, with the reverse factor by reciprocity.

Method: Analytical view factors for aligned parallel and perpendicular rectangles

Input parameters

Unit system: SI

Parameter	Value	Unit
Geometry	Aligned parallel rectangles X × Y, spaced Z apart	
Side X (common edge for perpendicular)	2.0000	m
Side Y (width of surface i)	1.0000	m
Spacing Z (parallel) or height of surface j (perpendicular)	1.0000	m

Calculated results

Parameter	Value	Unit
View factor from surface i to j	0.28588	
View factor from j to i	0.28588	
Area of surface i	2.0000	m²
Area of surface j	2.0000	m²

Notes for this case

• Analytical view factors for diffuse surfaces; reciprocity A_i F_ij = A_j F_ji gives the reverse factor. Other shapes follow by view factor algebra (sums and differences of rectangles).

Formula and method

$$\text{parallel}: \; F_{ij} = \frac{2}{\pi \bar{X} \bar{Y}} \left\{ \ln \left[\frac{(1+\bar{X}^2)(1+\bar{Y}^2)}{1+\bar{X}^2+\bar{Y}^2} \right]^{1/2} + \bar{X}\sqrt{1+\bar{Y}^2}\tan^{-1}\frac{\bar{X}}{\sqrt{1+\bar{Y}^2}} + \bar{Y}\sqrt{1+\bar{X}^2}\tan^{-1}\frac{\bar{Y}}{\sqrt{1+\bar{X}^2}} - \bar{X}\tan^{-1}\bar{X} - \bar{Y}\tan^{-1}\bar{Y} \right\}$$

$$A_i F_{ij} = A_j F_{ji}$$

Variables

$\mathrm{geometry}$	Geometry	-
X	Side X (common edge for perpendicular)	m
Y	Side Y (width of surface i)	m
Z	Spacing Z (parallel) or height of surface j (perpendicular)	m
F_{ij}	View factor from surface i to j	-
F_{ji}	View factor from j to i	-
A_i	Area of surface i	m²
A_j	Area of surface j	m²

Method and standards

Diffuse-surface view factors.

Assumptions and limits

- Diffuse, flat surfaces; no obstruction between them.

References

Analytical view factors for aligned parallel and perpendicular rectangles

Report details

Report reference	FCC-87JS-M705 (the same inputs always give the same reference)
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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/heat-transfer/view-factor-rectangles

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Reopens the calculator with the inputs of this report.