

## Solution to Exercise 3.1-1: "Calculate Geometry Factors"

Illustration

The geometry factor (always for a single vacancy) was defined as

$$g = \frac{1}{2} \cdot \sum_i \left( \frac{\Delta x_i}{a} \right)^2$$

With  $\Delta x_i$  = component of the jump in  $x$ -direction.

Looking at the [fcc lattice](#) we realize that there are **12** possibilities for a jump because there are **12** next neighbors.

**8** of the possible jumps have a component in  $x$  (or  $-x$ ) -direction, and  $\Delta x_i = a/2$

We thus have

$$g_{\text{fcc}} = \frac{1}{2} \cdot 8 \cdot \left( \frac{1}{2} \right)^2 = 1$$

Looking at the [bcc lattice](#) we realize that there are **8** possibilities for a jump because there are **8** next neighbors.

All **8** possible jumps have the component  $\Delta x_i = a/2$  in  $x$ -direction, again we have

$$g_{\text{bcc}} = \frac{1}{2} \cdot 8 \cdot \left( \frac{1}{2} \right)^2 = 1$$

Looking at the [diamond lattice](#) we realize, after a bit more thinking (or drawing, or looking at a ball and stick model), that there are **4** possible jumps.

All **4** jumps have the component  $\Delta x_i = a/4$  in  $x$ -direction, and we obtain

$$g_{\text{diamond}} = \frac{1}{2} \cdot 4 \cdot \left( \frac{1}{4} \right)^2 = 1/8$$