ANSWER: For any two values of $\tilde{R}_1$ and $\tilde{R}_2$, the parallel resistance is

$$\frac{1}{1/R_1 + 1/R_2} = \frac{R_1 R_2}{R_1 + R_2}.$$

Therefore the expected value of the resistance is

$$E\Big[\frac{R_1 R_2}{R_1 + R_2}\Big] = \frac{1}{(2\Delta R)^2} \int_{R-\Delta R}^{R+\Delta R} \int_{R-\Delta R}^{R+\Delta R} \frac{r_1 r_2}{r_1 + r_2}\, dr_1 dr_2$$

The details of the integration are messy and not very interesting.

8. What about the average conductance?

ANSWER: The average conductance is the sum of the average conductance for each resistor (whether or not the resistors are independent). Since $G = 1/R$,

$$E[G] = E\Big[\frac{1}{R}\Big] = \frac{1}{2\Delta R} \int_{R-\Delta R}^{R+\Delta R} \frac{1}{r}\, dr = \frac{1}{2\Delta R}(\ln(R + \Delta R) - \ln(R - \Delta R))$$