1 Answer

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$$F(x,y) = A_0 + \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} A_{m,n}\cos\left(\frac{m\pi x}{L}\right)\cos\left(\frac{n\pi y}{H}\right)$$

Multiply both sides through by $\cos(m'\pi x/L)\cos(n'\pi x/L)$ for arbitrary but fixed positive integers m', n' and integrate over $0 < x < L$ and $0 < y < H$. The orthogonality if these cosine functions on these intervals will cause all the terms in the series to vanish except when $m = m'$ and $n = n'$, resulting in

$$\int_0^H \int_0^L F(x,y)\cos(m'\pi x/L)\cos(n'\pi y/H)\,dx\,dy = A_{n'm'} \int_0^H \int_0^L \cos^2(m'\pi x/L)\cos^2(n'\pi y/H)\,dx\,dy$$

which implies

$$A_{n'm'} = \frac{\int_0^H \int_0^L F(x,y)\cos(m'\pi x/L)\cos(n'\pi y/H)\,dx\,dy}{\int_0^H \int_0^L \cos^2(m'\pi x/L)\cos^2(n'\pi y/H)\,dx\,dy}.$$

Since n' and m' were arbitrary dummy indices, we can change them to n and m. Also, the integral in the denominator equals $\frac{LH}{4}$, so we get

$$A_{nm} = \frac{4}{LH}\int_0^H \int_0^L F(x,y)\cos(m\pi x/L)\cos(n\pi y/H)\,dx\,dy.$$

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