Jacobi Anger identities

Starting with the generating function[1] for the Bessel functions

$$e^{\frac{1}{2}z\left(t-\frac{1}{t}\right)} = \sum_{n=-\infty}^{\infty} t^n J_n\left(z\right)$$

we can substitute $z = \Gamma$ and $t = e^{i\Omega t}$ (or $z = -i\Gamma$ and $t = ie^{i\Omega t}$) to get the cosine (or sine) form of the Jacobi-Anger identities:

$$e^{i\Gamma\cos\Omega t} = \sum_{n=0}^{\infty} i^n J_n\left(\Gamma\right) e^{in\Omega t}$$

$$e^{i\Gamma\sin\Omega t} = \sum_{n=0}^{\infty} \quad J_n\left(\Gamma\right) e^{in\Omega t}$$

These expressions show how phase modulation with modulation depth Γ is represented by a superposition of all harmonics of the modulation frequency Ω.

[1] `http://dlmf.nist.gov/10.12#E1`