This is an old post, but still... The relation

F\_0=1, F\_1 =1, F\_n = F\_{n-1}+F\_{n-2}, n \ge 2

defines a linear second order homogeneous difference equation. The solution can be found after computing the roots of the associated characteristic polynomial , which are . The general solution is then given by

F\_n= C\_1 \left(\frac{1 + \sqrt{5}}{2} \right)^n + C\_2 \left(\frac{1 - \sqrt{5}}{2} \right)^n

and the constants are computed knowing that . so, finally,

F\_n= \frac{1}{\sqrt{5}} \left(\frac{1 + \sqrt{5}}{2} \right)^n - \frac{1}{\sqrt{5}} \left(\frac{1 - \sqrt{5}}{2} \right)^n

This is obviously equivalent to Binet's formula, but provides a general process to deal with linear recurrences.