The precision of an analytical solution for some specific time t does not depend on the precision used in any other calculations for other times.

An iterative or numerical solution, on the other hand, is such that every calculation of each time t has its precision dependent on the precision taken for the previous calculations.

But I still have the impression there are more fundamental differences between the two, that the existence or inexistence of analytical solutions has something to say about the system itself.

Uma solução analítica tem complexidade temporal O(1) e geralmente também complexidade espacial O(1) .