Parallel numerical libraries for modern architectures can be finely optimized. However, this optimization process may require to carefully set up many parameters, which can be a pretty cumbersome task when done manually. For instance, modern dense linear algebra libraries often split the matrix in submatrices whose size may significantly impact performance. Similarly, the scheduling policy may be of importance, especially when dealing with heterogeneous architectures. Possibly, it may also be interesting to let computational units idle. In this work, we discuss how to automatically decide the selection of these parameters. The idea is that, during a preliminary phase at install time, well chosen tests are performed, so that, once the library has been installed, these parameters get automatically (and instantly) decided while achieving an overall performance close to optimum. We illustrate our discussion with the Chameleon dense linear algebra library running on top of the StarPU runtime system. We use the SimGrid simulator to predict the performance of time consuming executions (large matrices) and hence reduce the time spent in the autotuning phase.