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During the detailed design phase of an aerospace program, one of the most important consistency checks is to ensure that no two distinct objects occupy the same physical space. Since exact geometrical modeling is usually intractable, geometry models are discretized, which often introduces small interferences not present in the fully detailed model. We focus on computing the depth of the interference, so that these false positive interferences can be removed, and attention can be properly focused on the actual design. Specifically, we focus on efficiently computing the penetration depth between two polyhedra, which is a well-studied problem in the computer graphics community. We formulate the problem as a five-variable constrained global optimization problem, and then derive an equivalent unconstrained, 2-variable nonsmooth problem. To solve the optimization problem, we apply a popular stochastic multistart optimization algorithm in a novel way, which exploits the advantages of each problem formulation simultaneously. We apply our algorithm to 14 randomly generated pairs of penetrating polytopes and show very promising results. (Received August 31, 2020)