1096-68-2686 **Michael McKerns*** (mmckerns@caltech.edu), 1200 E. California Blvd. MC158-79, Pasadena, CA 91125, and **Tim Sullivan**, **Clint Scovel** and **Houman Owhadi**. *mystic: a framework for high-dimensional nonlinear constrained optimization.* Preliminary report.

We have built a framework (mystic) for solving high-dimensional non-convex optimization problems with highly nonlinear constraints. Mystic is capable of solving global optimization problems with thousands of parameters and thousands of constraints, and can leverage high-performance parallel computing. Mystic's unique ability to apply statistical constraints can be used to calculate risk, uncertainty, and probability of failure in real-world inverse problems. Typically, termination conditions and initial conditions are hard-coded into an optimization algorithm - however, in mystic, conditionals are dynamically configurable, and thus facilitate optimizer tuning to solve a much broader range of problems. Mystic provides box constraints, penalty functions, and a constraints toolkit inspired by set theory that applies constraints as operators. With the ability to scale up to thousands of parameters, mystic can solve optimization problems that are orders of magnitude larger and of greater complexity than conventional solvers are capable of. Mystic has been used in materials failure under hypervelocity impact, elasto-plastic failure in structures under seismic ground acceleration, and structure prediction in nanomaterials. Mystic is available at http://pythonhosted.org/mystic. (Received September 17, 2013)