

A method to find the 50-year extreme load during production

René Bos

Delft University of Technology (DUWIND)
r.bos-1@tudelft.nl

Dick Veldkamp

Suzlon Energy Ltd
h.f.veldkamp@suzlon.com



A designer has to evaluate

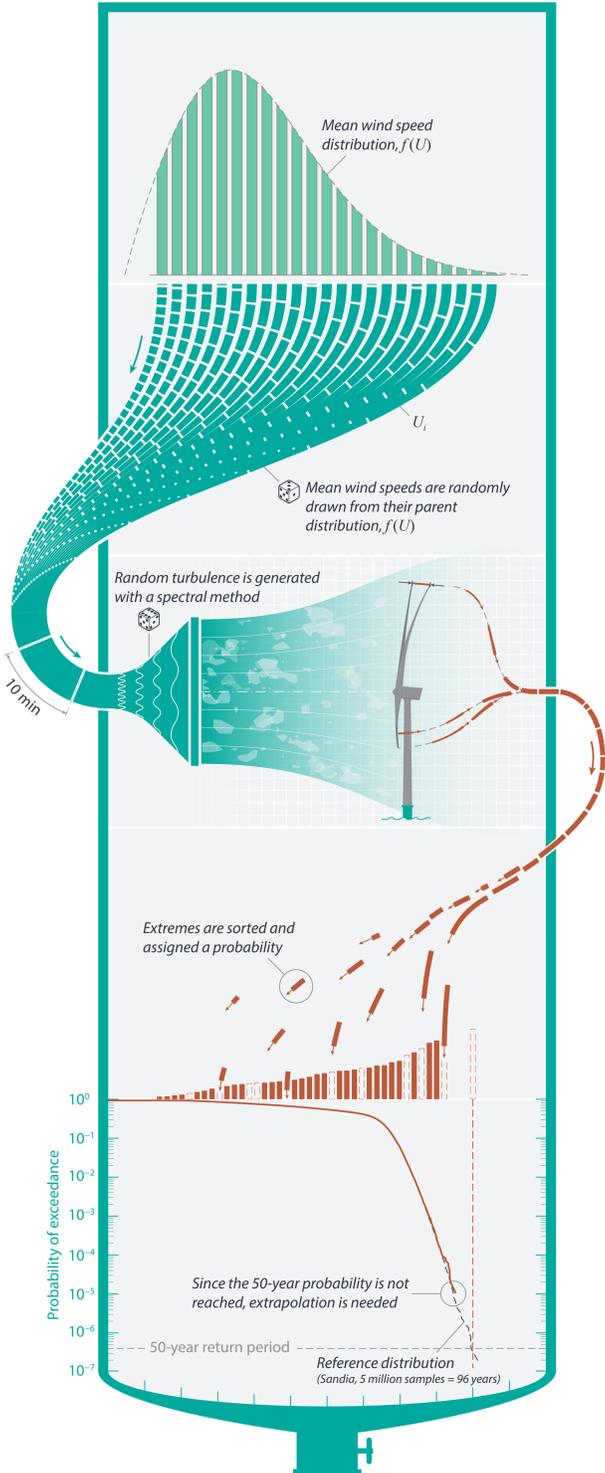
2.6 MILLION
ten-minute wind fields to determine
the 50-year load level by brute force

Are there smarter ways to reduce the
computational burden?

Abstract

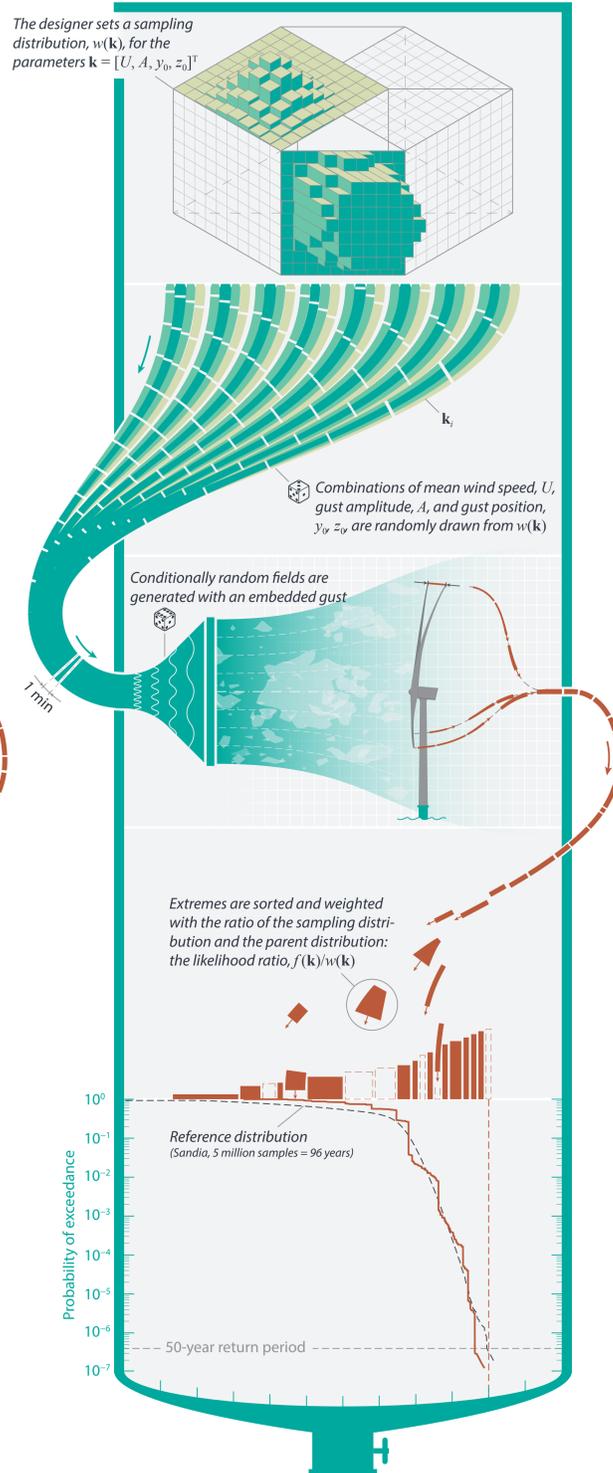
An important yet difficult task in the design of wind turbines is to assess the extreme load behaviour, most notably to find the 50-year level. Where existing methods focus on ways to extrapolate from a small number of simulations, this paper proposes a different, more efficient approach. It combines generation of constrained gusts in random turbulence fields, Delaunay tessellation to assign probabilities and a genetic algorithm to find the conditions that produce the 50-year load. Results of the new method are compared to both Crude Monte Carlo and Importance Sampling, using the NREL 5MW reference turbine. We find that using a genetic algorithm is a promising approach, with only a small number of load cases to be evaluated and requiring no user input except for an appropriate fitness function.

CRUDE MONTE CARLO



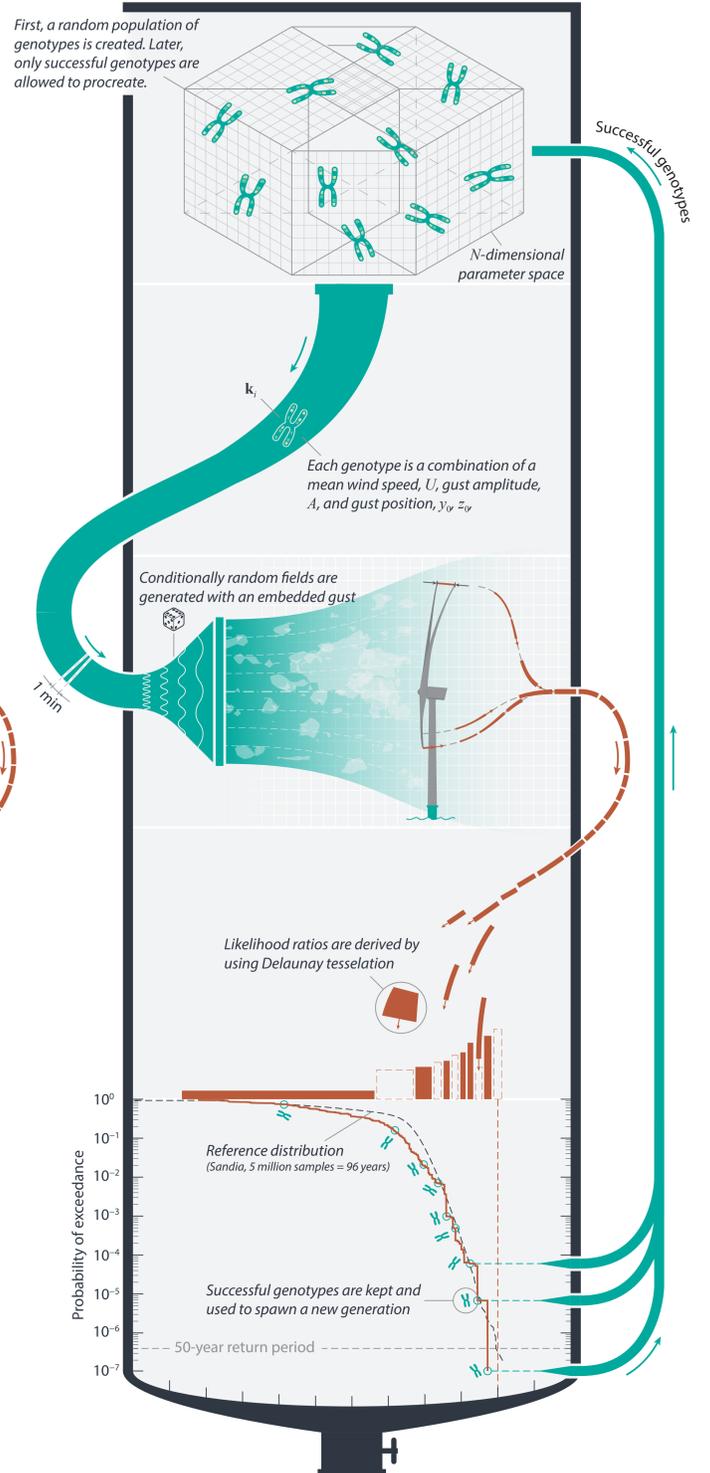
2 years

IMPORTANCE SAMPLING



2 weeks

GENETIC ALGORITHM



2 days

Simulated time to stay within a 3% error: