

2.f. Using SIMULATED ANNEALING to improve a model design

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The problem

An existing model of a complex system (hundreds of different components with feedback relationships) provides some accuracy when compared with field experiments, but is not perfect. Trial and error adjustments would take too long because of the system complexity. The example considered involves the simulation of water flow in soil pores (Aitkenhead *et al.*, 1999), where simulated annealing was used to develop accurate aggregate structure.

Data available

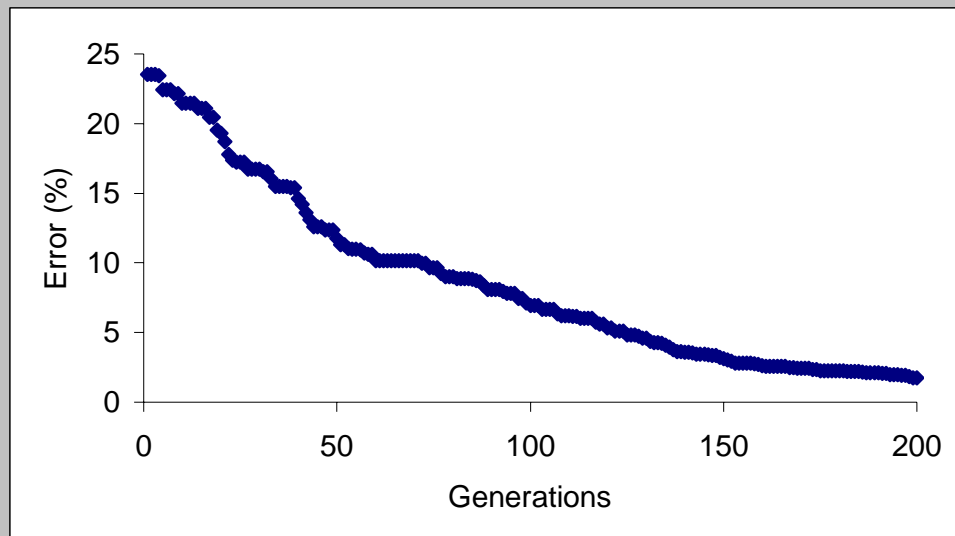
Model parameters (constants, relationships expressed as equations) and field data.

Why use simulated annealing and not another method?

Trial and error is too slow, and the system feedbacks prevent multivariate analysis

Simple description of how it was done

The model parameters are mutated by some value proportional to the level of inaccuracy between model and reality, and the inaccuracy of the new model measured. If the model has been improved, accept the changes and repeat. If not, reject the changes and repeat. The process is iterated until a satisfactory level of accuracy is achieved.



Software used and alternative generic packages that could be used

Visual Basic, C++ etc.

Reference

Aitkenhead MJ, Foster AR, FitzPatrick EA and Townend J (1999). Modelling water release and absorption in soils using cellular automata. *Journal of Hydrology* 220: 104-112.

Further reading

Kirkpatrick, S., Gelatt, C.D., Vecchi, M.P., 1983. Optimization by Simulated Annealing. *Science* 220, 4598, 671-680.