On Short-lived Hypes and failures in OR

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I was definitely enthusiast when I was invited to celebrate Manuel's birthday in Vienna but the panel's topic was a serious challenge. We are used to talk about 'success stories', or, at least, what we perceive as success stories, but failures are also instructive and I found very interesting the idea, arisen during the panel discussion, of proposing a *Journal of Failures*. It took me a lot of time to find something to say. In the end I decided to reconsider my works and to discuss one of my research topics which I would not currently investigate any more, namely Simulated Annealing. SA is inspired by a physical phenomenon. Reducing the temperature of a liquid, the thermal mobility of the molecules is also reduced. If the decrease is slow enough, a pure crystal is formed corresponding to a state of minimum energy, while if the decrease is too fast, a polycristalline or an amorphous state, with higher energy, are reached. By the way, probably, my initial enthusiasm to take part to the panel was cooled down too fast when I read the panel's topic, so that I am not sure that I reached the globally optimal solution in preparing my contribution. In SA a Monte Carlo method is used to simulate the physical process where the energy of the system is equal to the objective function, while a parameter T, called temperature, controls the ability of accepting non improving moves through the following formula

$$\min\left\{1, \exp\{(f(y) - f(x))/T\}\right\}.$$

Basically, if T is close to 0, non improving moves are accepted with a low probability and the algorithm mostly performs a local search, while if T is large non improving moves are accepted with a high probability and the algorithm is able to climb barriers between local minima, thus performing a global search. All this leads to a nice theory showing that if local moves are performed, where the new incumbent is generated in a neighborhood of the current point, and T is reduced slowly enough, as in the physial process, namely, as

$$\frac{D}{\log(k)},$$

where D is a constant depending on the problem and, more precisely, on the height of the barriers, while k is the iteration counter, then the global minimum is reached with probability one. During my first research years I spent a lot of attention towards SA and its theoretical properties, but later on I realized that in practice I would hardly suggest someone to use it, at least in the field of continuous optimization. I am not aware of real success stories for SA in this field. The idea of accepting non improving moves makes sense but probably a good mechanism to generate new incumbents is more important.